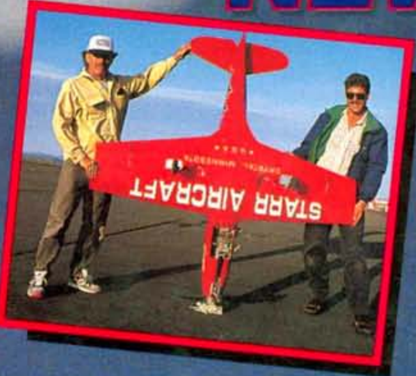
R/C VERTICAL TAKEOFF SECRETS REVEALED

MODEL AIRPLANE NEWS

48120 October 1993

THE WORLD'S PREMIER R/C MODELING MAGAZINE



RENO Unlimited Races

NEWEST CRAZE:
European Electric Pylon

Fitzpatrick .61
DOES IT LIVE UP TO CLAIMS? page 96

GREAT PLANES
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- Giant-Scale Fiberglassing
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- Using Flaps and Flaperons

MODEL AIRPLANE NEWS

FEATURES

ABOVE: *the Stealth 1/2A—a small airplane that handles like a larger one—flies up a storm in columnist Dave Baron's backyard (see construction article). Photo by Tom Atwood.*

ON THE COVER: *upper right—Dick Sizer (left) and Bryan Keil hold the 51.5-pound P-63 racer, which took Best of Scale and Pilots' Choice in the Unlimited Class at the recent Reno races. Center—Classical Racing Team's X84, which took fifth place in Gold. Lower left—Duke Crow pilots Race 99 on final after qualifying. (Photos by Rob Wood.)*

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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EDITORIAL

TOM ATWOOD

WHERE R/C MEETS THE FUTURE

The sport of R/C aeromodeling encompasses an almost magical diversity of paths; where the modeler will travel depends, for the most part, only on his or her imagination, inclination and available time. I was reminded of this during a recent conversation with Robert Vess on the upcoming '93 Competition Fun Fly NATS (Sept. 4 and 5, Raleigh, NC; for information, call (919) 790-1444). Robert, codirector of the Fun Fly NATS, digressed for a moment to tell me a little about his work at the North Carolina State University Department of Mechanical and Aerospace Engineering. A research project that uses mostly off-the-shelf modeling gear in the search for answers to serious design questions also sounded like serious R/C fun. At my request, he kindly provided the following overview:

"In the interest of expanding the horizons of air travel to keep pace with the demands of global commerce, there is an ongoing research initiative within the aerospace industry to develop the next generation supersonic transport. Most of the independent studies specify configurations reminiscent of the present day Concorde with highly swept wings and slender fuselages. This 'High-Speed Civil Transport' (HSCT) is intended to carry 300 passengers more than 5,000 nautical miles at a cruise speed of Mach 2.4, which is faster than many fighters! Most important, it will be a very practical means of travel, since the 'coach' seat price is projected to be comparable to today's first-class fares.

Fly-over of three-surface configuration; note leading- and trailing-edge control surfaces, painted red. (Photo by Jeff Stafford.)

Catapult launch of the canard configuration. (Photo by Jeff Stafford.)

"One of the major design considerations involves low-speed aerodynamics. While the vehicle is generally optimized for high-speed flight, it must still demonstrate safe, efficient flight characteristics during take-offs and landings. Most of the proposed designs implement sophisticated flap systems to address this issue. Although the flaps effectively allow the wing to be reconfigured for any specific flight condition, they significantly affect the aircraft trim characteristics and, thus, tend to drive the sizing and placement of the horizontal stabilizer.

"North Carolina State University, in cooperation with NASA Langley Research Center, embarked on a project to design, analyze, fabricate and flight test research RPVs to evaluate some of the tradeoffs associated with tail position on a generic HSCT configuration. Three models with a common wing, but different tailplanes were constructed. Respectively, these feature a conventional aft tail, a forward-mounted canard and a three-surface design with both a canard and aft stabilizer. All the work was performed by senior aerospace engineering students under the guidance of Dr. John Perkins, Robert Vess and Dr. Charles Hall.

"The models feature molded composite construction with Kevlar skins, carbon-fiber spar caps and balsa/plywood internal structures. They are approximately 9 feet in length and weigh 14 to 16 pounds. The control surfaces, which include fully articulated leading- and trailing-edge flaps, are driven by JR PCM 10 radio equipment. Power is provided by O.S. Max 1.08 engines with an external pump/regulator system that allows fuel to be drawn from a tank located at the aircraft center of gravity. Each aircraft also carries an on-board digital flight computer that provides pitch stabilization. This allows flight tests to be safely performed at varying levels of stability, including some which would not be possible without augmentation.

"A typical flight scenario begins with a catapult launch from a dolly. Performance is judged by pilot assessment of handling and trim, or through real-time recording of various flight parameters. The aircraft is then recovered to the runway via landing upon integral skids. This procedure has been successfully employed during many test-flight sessions. Although the entire comparative flight-test program has not been completed, the aircraft have repeatedly demonstrated that, with proper design practice, significantly different configurations can be tailored to meet specific design goals. The relative benefit of any single design has yet to be revealed from the acquired data.

"North Carolina State's aerospace engineering program has included undergraduate design and flight testing of RPVs for more than 10 years. During this period, the complexity of the projects has continually evolved, and has shown that "real-world" problems like the HSCT can be successfully addressed in an educational environment."

Thanks, Robert, for sharing with our readers a glimpse of how R/C models are playing a role in the development of future civilian transport planes. A closer look at some of the past, present and future R/C projects at N.C. State will likely be the subject of future articles. Watch for them! ■

MODEL AIRPLANE NEWS

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AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

NOISE-REDUCTION ANSWERS

I'd like to make a few comments on the two-part series on noise reduction in the July and August '93 issues, and offer some suggestions that may help those trying to make their airplanes quieter.

First of all, it is relatively easy to get the noise down to 80dB at 9 feet. The hard part is doing that while still producing enough power to fly. Let me start out with a little background. For the past six years, the fliers in the FAI pattern class have been struggling with this dilemma. If you didn't pass the noise test for each flight, the score for that flight was *zero!* At one point, some fliers resorted to somewhat unethical means to pass the ground noise test, and this resulted in airplanes that were noticeably noisier in the air. As a result, FAI flights are now also judged for in-flight noise. This is solely based on whether the airplane sounds quiet, average, or noisy—this isn't relative to anything—and a bonus or penalty is given. Some final placings at major contests were changed by these bonuses and penalties. Because of this, work began in earnest to make the airplanes truly quiet.

These are the things that we've found that work to quiet the airplane and still have the performance you want:

For a 2-cycle engine, a tuned pipe is a must. Don't let this scare you off. To be quiet, the engine has to operate at a lower rpm. In the past, tuned pipes have been used to raise rpm. By lengthening the header to the pipe, the torque curve of the engine is shifted to a lower rpm range. This allows the engine to turn a larger prop at a lower rpm without the overheating problem. Not all tuned pipes are created equal. I recommend the Hatori YS tuned pipes. They have a broad tuning band, are very good silencers and give a good power increase.

For an "off-the-shelf" prop, you can't beat the APC line. It will take some trial and error to get the right prop for your particular installation. Because of the lower rpm, higher pitch is necessary to get the proper flight speed. The lower rpm also allows larger diameter props for better efficiency.

Once the exhaust system and the prop are quiet, a soft mount will make a big difference. Noise-testing a soft mount on the ground can be very deceiving. With the airplane on the ground, a lot of the noise from vibration is absorbed by the ground and the person holding the airplane. Remember, noise from an airborne model is what we are trying to reduce.

The article mentioned that the nose of the airplane should be beefed up when you use a soft mount. If this is necessary with your soft mount, you are using the wrong soft mount! With high-performance .61 engines, we are using 1/8-inch plywood firewalls! Because the mount should be absorbing the harsh vibration from the engine, the airframe can be built much lighter. I recommend the Performance Products Vibra-Damp engine-mount line. They are lightweight, easy to use, will fit most of the model airplane-type engines, and they've been tested to give the most reduction in vibration.

An air filter will further reduce noise. The wrong air filter will reduce noise *and power*. The Tettra metal screen filter seems to work the best here.

A metal spinner can be a small source of noise. Sound-deadening foam placed in the spinner will eliminate the noise from the spinner. Be extremely careful of the spinner balance when doing this. Also, make sure the foam doesn't shift while you're running; shifting can cause an out-of-balance condition.

Once the major noise sources have been significantly reduced, sounds that were previously masked will be very noticeable. You may hear air noise over openings and around the airplane, the whistles and buzzes of loose coverings and the rattling of loose wheels and pushrods in oversize exit holes. Be careful not to judge the performance of the airplane solely by the engine rpm. Lower rpm will give the impression that the airplane is flying slower than it was before.I hope this may have made it easier for readers to quiet their airplanes. Long gone are the days of screaming engines at a pattern contest. Now you'll find people whispering so as not to distract the judges or pilot!

DAVE VON LINSOWE
Mount Morris, IL

Our thanks to Dave for his insights on quieting model aircraft. I'm sure many readers (and, hopefully, some flying fields) will benefit from his comments. Congratulations also to Dave for winning the recent F3A pattern masters team selection qualifier. He will lead the U.S. team (which includes Bill Cunningham and Tony Frackowiak) at the F3A World Aerobatics Championships in Austria, in September of this year.

Here are the souces of the products Dave mentioned: Hatori YS is distributed by Futaba Corp. of America, 4 Studebaker, Irvine, CA 92718; (714) 455-9888.

APC propellers are sold by Landing Products, P.O. Box 938, Knights Landing, CA 95645; (916) 735-6475. Vibra-Damp soft mounts are sold by Performance Products (owned by David von Linsowe), 7093, E. Dodge Rd., Mount Morris, MI 48458; (313) 631-4894.

Tettra metal screens are sold by Steve's Hobbies Unlimited, 6265 Lake Leven Dr., San Diego, CA 92119; (619) 461-5421.

In addition to the articles that triggered Dave's letter ("Reducing Engine Noise," Parts 1 and 2, by Ray Abadie and Denny Atkins—July and August issues), modelers who are seeking recent comments on how to quiet models should see, in our September issue, Dave Patrick's "Aerobatics Made Easy," Howard Crispin's letter in "Airwaves," and Steve Helm's paraphrased comments in the "Editorial."

To help save flying fields, we would like to publish more practical information on quieting techniques and hardware; do you have information you'd like to share with our readers? Write to Tom Atwood, c/o "Model Airplane News," 251 Danbury Rd., Wilton, CT 06879, or fax us at (203) 762-9803.

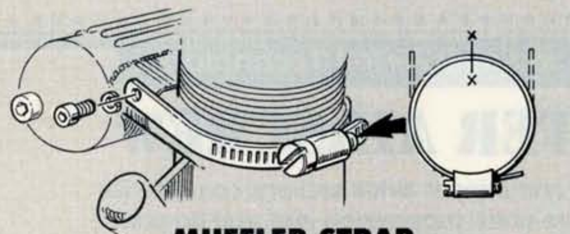
TA

(Continued on page 64)

HINTS & KINKS

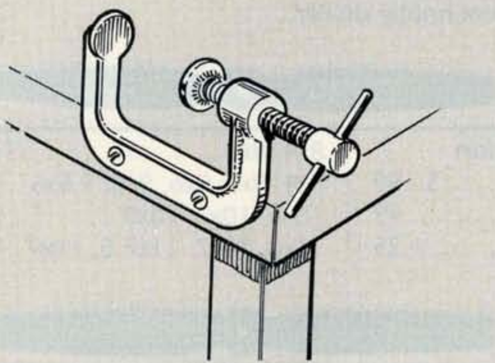
JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o *Model Airplane News*, 251 Danbury Rd., Wilton, Ct 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



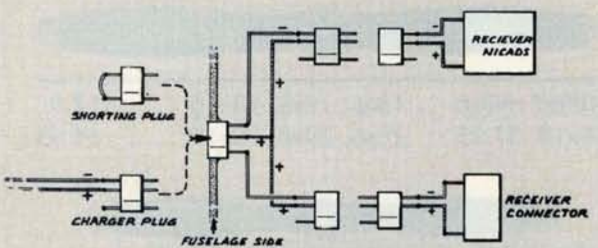
MUFFLER STRAP

A broken muffler strap can be very inexpensively replaced with a suitable hose clamp from a hardware store. Cut through it at the Xs, drill as shown, and install it using lock washers and screws tapped into the exhaust stub. Use high-temperature silicone sealant between the muffler and the engine exhaust stub. *Jamshed Ishrat, Rawalpindi, Pakistan*



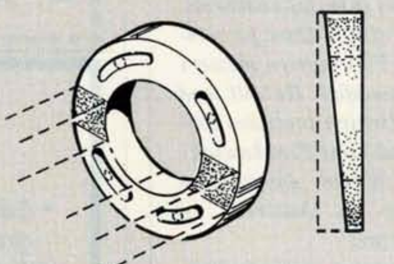
MINI VISE

To make a vise for small parts, drill two holes in a 3- or 4-inch C-clamp, then screw it to a corner of your worktable. *Gene Chase, Oshkosh, WI*



COMBINATION SWITCH AND CHARGE PLUG

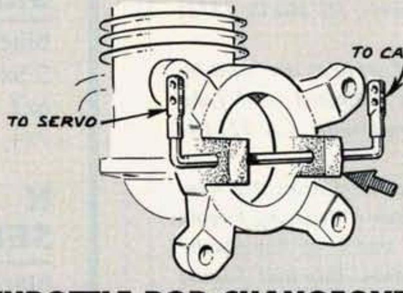
This is ideal for small, light models because it uses a featherweight Deans plug to "jump," or short across, the circuit to turn the receiver on. Remove the plug to turn the system off, then insert the charger plug, wired as shown, to charge the flight pack. All plugs shown (except the receiver connector) are Deans plugs from Ace R/C. Note: the middle pin has been removed from the shorting plug. *H. Dan Moser, Post Falls, ID*



RECYCLED ENGINE MOUNTS

Save broken, glass-filled engine mounts. File off the remaining beams, then slot each mounting hole and file or machine a 2-degree slope on the mounting ring to make a downthrust wedge. You can use a disk or belt sander to do this. The slots allow a slight rotation to trim in a limited amount of combination down and side thrust. Save the offcut pieces, too. This tough material has a dozen uses, such as for cowl mount blocks, which will readily take screws without stripping.

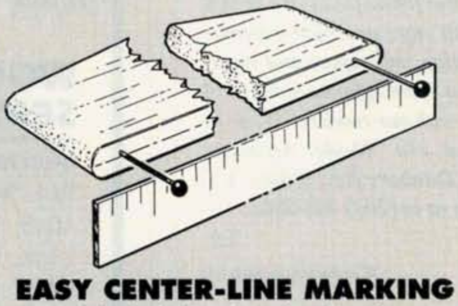
Ray Gareau, Laval, Quebec, Canada



THROTTLE ROD CHANGEOVER

Ian changed his engine from a 4-stroke to a K&B Sportster, and easily changed the throttle pushrod from left to right. He rotated the "spider" engine mount 90 degrees and ran a layshaft across the back of the engine using the defunct nose gear bearing blocks, (indicated by the arrows).

Ian Danby, Kincardine, Ontario, Canada



EASY CENTER-LINE MARKING

To keep your straightedge balanced on the edge of a narrow surface, insert two pins as shown, then butt the straightedge up against them as you draw your line. *Craig Greenwood, Chandler, AZ*

AIR SCOOP

CHRIS CHIANELLI

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

Dr. Volton's Report

Electric-flight pioneer Keith Shaw—designer of the amazing, scale, electric, ducted-fan model of the Horten Flying Wing—has just finished stage one of his research on the Aveox brushless motor and controller. Here are his findings: "After a few minor bugs were corrected on the prototype, the system performs as claimed.... Without the usual arcing at the brush/commutator interface, there is no loss of radio range during operation and, of course, virtually nothing to wear out or age. The Aveox system requires 10 to 15 percent less input watts to reach the performance of a comparable brush-type cobalt motor. I've tested mine up to 400 watts and believe it could operate at much higher power levels. I modified my 'Coulombia' [1983 electric pattern design] to test the system. The design has a 50-inch span with 440 square inches of area and originally flew with a Keller 25 on 12 cells. Performance is noticeably better (with longer duration) with the Aveox on eight cells!"

Thanks for sharing your results with the rest of us, Keith. For more information on this system, contact Aveox Inc., P.O. Box 1287, Agoura Hills, CA 91376-1287; (818) 597-8915.

BACKYARD BARNSTORMER

Andy Clancy of Clancy Aviation designed the Lazy Bee so that he could fly in his backyard, but when it caused a sensation at the field, he decided to offer plans and semi-kits. With large control surfaces and an extremely low wing loading of 6 ounces per square foot, the Lazy Bee possesses amazing low-speed characteristics (according to its manufacturer.) Specifications: wingspan—40 inches; wing loading—4.1 to 8.2 ounces per square foot (depending on engine size); engine required—.049 to .15 2-stroke. Contact Clancy Aviation, 219 W. 2nd Ave., Mesa, AZ 85210; (602) 649-1534.

Nocturnal Man-Eater

Plans for the Northrop P-61 "Black Widow," which, during WW II delivered its deadly sting under the cover of darkness onto the Axis powers, are now being offered by the scale master himself, Nick Ziroli (looking very pale next to the blackness of the Widow.) The 84-inch-long design has a 114-inch wing with 1,875 square inches of area and calls for two 35 to 52cc gasoline engines,

or equivalent glow power. Fiberglass cowls and nose, plus all vacuum-formed parts—such as canopy set (three pieces), turrets, leading-edge inlets and wheel fairings—are also available from Nick Ziroli Plans. Retracts (P-61Z) are available from Robart. Contact Nick Ziroli Plans, 29 Edgar Dr., Smithown, NY 11787; (516) 234-5038.

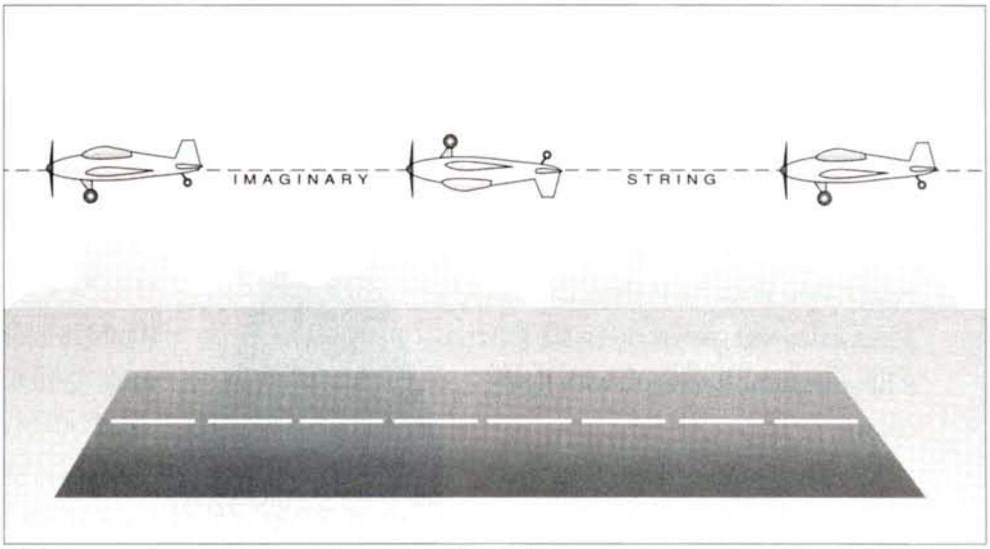
Stealth 888

That creative inter-modular static-field buildup between the minds of Dave Abbe, of DAD (Dave Abbe Development Co.) and Ace R/C Inc. president Tom Runge recently reached the saturation point and suddenly discharged in a flash of brilliance, giving rise to this tiny black box, dubbed "Stealth 888!" Seriously, this .88-ounce, 8-channel, American-made FM receiver measures only 1.125x1.437x0.812 inches! Just think of where you can stick this one. Dave and Tom have been overheard chanting, "Too small to hit, too hot to catch, bullet-proof not enough in the '90s." Now, what do they mean by that? Rumor has it that you can lock on your personal set of stereoscopic inspection devices at the next Chicago RCHTA Show this November. More to come.

AEROBATICS MADE EASY

DAVE PATRICK

BACK TO BASICS



When you can place a roll on the string—in the middle (and in a crosswind)—you have full control of that roll.

OVER THE PAST few months, we've discussed everything from Lomcevaks to soft mounts; this month, we're going to focus on some very important fundamentals that even the "pros" practice. Before getting into specifics, now is a good time to remind you that all aerobatics are based on only a few basic components: rolls, loops, snaps/spins, or a combination of these. Once we've learned the maneuver, we work on the second phase: line, position and symmetry. This is extremely important, not only to the competitor, but also to the average flier who's looking to improve his piloting proficiency. It's one of the foundations of good flying.

Simply put, learning the maneuver is important, but being able to execute the maneuver exactly where you want it, and in any reasonable flying weather, really requires something more than just being able to fly the maneuver: it requires full control. The following technique can be used to work toward the level of control you want to achieve.

THE LINE

The "line" is an imaginary string you place in the sky. The object is to fly your plane over it consistently and exactly. It isn't as easy as it may seem! Try it! A good way to start is to mentally place your invisible string, let's say, 100 feet out and 75 feet high, parallel to the runway. Try to fly up and down this line. You'll quickly find that a good approach or setup is the key to achieving this goal. A half reverse Cuban-8 or Humpty Bump, or a simple procedure turn after each pass is a great way to end up back on "line" each time.

You'll also discover how to compensate for a crosswind by pointing the nose slightly into the offending breeze. Of course, the stronger the crosswind, the higher the compensating angle has to be. I can go deeper into the subject, but it's much simpler for you to go out and try to fly the line in a variety of crosswinds. With a little practice, you'll get a feel for the correct compensation angle. Believe me, this is extremely productive practice that really builds your flying skills.

POSITION

Once you're comfortable with flying a consistent line, try a roll. See if you can keep the plane on that invisible string. Now you're learning what *real control* of your aircraft is. Practice until you can enter and complete a roll on the string without losing heading or altitude. It isn't easy. (But a roll is such an *easy* maneuver. Right!) You may want to start your practice at a higher altitude. Then, as you become more comfortable, work your way down to a lower altitude.

Here, again, we're practicing the building blocks of proficiency. It isn't that any one step is hard, but by taking one step at a time, and in the right order, we begin to take real control of our aircraft.

SYMMETRY

But we're not done yet! After you have the hang of placing that roll on the infamous string, try to place the roll in the string's midpoint. Better yet, as you cross the midpoint, you should be at the inverted portion of the roll. Only when you can place that roll on the string—in the middle—in a crosswind can you be satisfied that you have full control of a roll. (Oh, by the way, you must be able to do this while flying in either direction!)

Here, we've developed a simple, precisely flown roll not only for the competitor, but also for the sport flier. Only a few of us aspire to hit the contest trail, but I believe most of us want to develop and improve our flying skills. Let's face it, flying is a heck of a lot of fun, and doing it well and safely is icing on the cake!

MORE ON LOMCEVAKS!

It's hard to believe the response to the Lomcevak article I wrote! Please understand that I can't respond to all the letters I receive, but I will try to answer a few that may benefit my fellow modelers.

Getting back to the Lomcevak, Jiri

Fleisman sent me a very nice letter all the way from Czechoslovakia. He says that the correct spelling is "Lomcovak," and it is his belief that the word came from "lomcovat," which means to shake—with somebody. Therefore, the "lomcovak" means "shaker"...interesting.

John Jundt from Dublin, OH, sent another interesting letter. He copied some outstanding information from a book called *Flight Fantastic* by Annette Carson. (I have to get a copy of this book. It sounds great!) It tells a story about a mechanic explaining to a journalist that a maneuver being performed is a Lomcevak—which turns out to be a slang word in the Moravian dialect for the aftereffects of too much "slivovitz." It goes on to say that the term is misinterpreted to mean hangover or headache, but that it really means a swaying gait similar to Charlie Chaplin's. Well, it's supposed to be a pilot's joke that only a Moravian could understand.

This was supposed to have occurred in 1958—frankly, earlier than I had thought. The book goes on to say that a Czech named Ladislav Bezak not only invented the maneuver, but was also the first to fully develop the flat spin! He went on to win the world aerobatic championships in 1960. He also went on to escape from Czechoslovakia in 1971 by flying his entire family in a Zlin 526 two-seat aircraft! The story is incredible and would make a great movie!

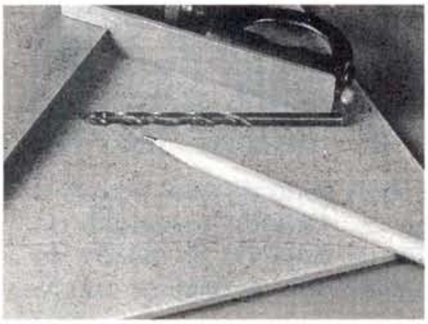
Well, that should do it for this month. Just remember, practice makes perfect; but don't practice too hard, or it may take some of the fun out of this great sport!

HOW TO:

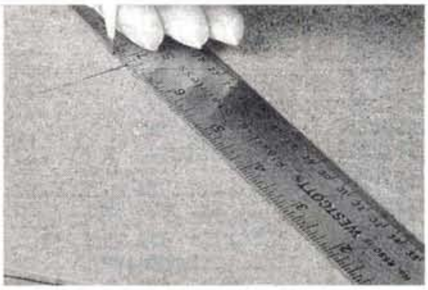
RANDY RANDOLPH

MAKE A HANDY JIGSAW TABLE

The Dremel jigsaw is one of the first power tools most modelers acquire. You really need one to accurately saw plywood and the thicker sheets of balsa. These pictures show how to make a useful tabletop that will help you get the most out of your tool.



1. You'll need: a 12- or 18-inch square of 1/8-inch Masonite; 1/16-, 3/32-, 1/8- and 3/16-inch drill bits, a straightedge; a square; and a pencil. Tempered Masonite is best, but it isn't necessary.

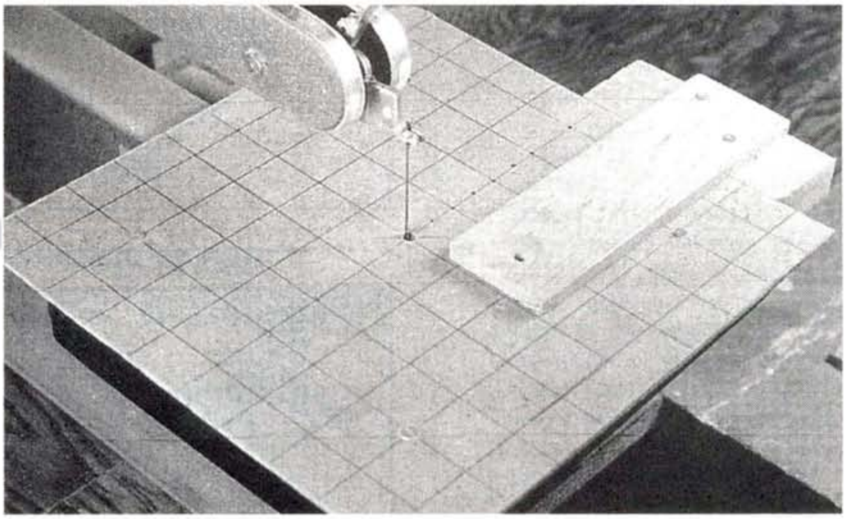


2. To find the center of the Masonite, place a straightedge along one diagonal from one corner to the other, and draw a line near the center. Repeat for the other diagonal. The exact center is the point at which both lines cross.

3. Use a square or a right triangle and draw a vertical and a horizontal line that cross at the center. Starting at the center, use a ruler to mark 1-inch spaces along both lines. Add marks spaced 1/2 inch apart along the right side of the horizontal line.

4. Following the marks, use the square to draw a checkerboard of 1-inch squares on the entire tabletop. These will make it much easier to gauge the depth of the notches and slots when you saw.

5. Drill a 3/16-inch hole in the center of the tabletop, and drill a series of 1/16-inch holes on the 1/2-inch marks along the center horizontal line. Drill and countersink four 1/8-inch holes that are 3 inches from the center on the diagonal. These are for the sheet-metal screws that will anchor the table to the saw.



6. Center the tabletop on the saw, and mark the locations of the mounting holes on the metal saw table. Drill 3/32-inch holes at each location, and mount the saw table with four, 1/2-inch flat-head sheet-metal screws. A simple T-square that can ride on the edge of the new table will make sawing 90-degree angles a snap. You can make a pivot for sawing circles by placing a finishing nail in one of the 1/16-inch holes.

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects", we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1993. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

MESSAGE OF ADMIRATION

Mori Ohkochi, who lives in Chigasaki-Kanagawa, which is 35 miles outside of Tokyo, is an ardent admirer of the Rich Uravitch designs that have appeared in *Model Airplane News*. He built the Texan from a House of Balsa kit and found it most enjoyable. Ohkochi-san states, "She does fly so high and mighty as I power her with an O.S. .25 2-cycle engine. I particularly enjoyed reading the instruction booklet. It is one of the most 'builder-friendly' I have ever read. I'm keeping it for a reference for simple and to-the-point style." Mori is a Japanese to English (and vice versa) translator for electronic technical documents, so he should know. Mori is currently working on Rich Uravitch's Extra 3.25 from the January '93 pull-out plan.

OUR KAIBIGAN ("FRIEND") FROM THE PI

Pensive Pops Garcia from Metro Manila, Philippines, is pictured here with his O.S. .25-power DC-3 built from *Model Airplane News* plans no. 2891 designed by David A. Ramsey. Pops writes, "The plans are well laid out, which made building the DC-3 enjoyable and plenty of fun—very satisfying indeed! On the test flight, the DC-3 was just wonderful. It flew like the real thing. Let me congratulate Mr. D.A. Ramsey and *Model Airplane News* for a model that builds easily and is a pleasure to fly. It became the envy of our field. May you continue to offer such plans for the R/Cers of the world!" We will try. You can relax and smile now, Pops; the test flights are behind you.

MODELING IN PARADISE

This is a photo of Lui Czukelter's Goldberg Cub, dog and helper 100 feet from a private airstrip at Plantation Island Resort on Fiji, replete with sailboats in the background. We're told the mean temperature in your part of the world is 79.5 degrees. If modeling in paradise exists, you're the proof Lui; we're all envious. Lui's life as the lonely island modeler is not without problems, however. Being self-taught, he hasn't quite mastered takeoffs and landings with this tail-dragger. If you have experience with this plane and would like to help, contact Lui at 1 Gallery of Arts, P.O. Box 10139, Nadi Airport, Fiji. Even the address sounds idyllic.

SLOW SWISS TURNOVERS

Peter Meier, of Zurich, Switzerland, scratch-built this ¼-scale Klemm L 17 using only black-and-white photos that were taken in 1924. Its wingspan is 127.5 inches and it weighs about 13 pounds. Power is supplied by a Laser V-2 1.50 4-stroke. The Klemm features rotating wingtips that are coupled to the ailerons. Peter writes, "With this old-timer, it is possible to make very slow overturnings. *[We're sure this translates into 'rolls.']* I am looking forward to the next issue of *Model Airplane News*." Well, here it is Peter, and we hope the inclusion of your Klemm pleases you!

THE TOWER STANDS BY MERLIN REMAINS

This is Jack Kilmurray's Quadra 42-power ⅕-scale Pica P-51D, built by his pal Dave Biddington. It's parked at an airfield in Weston Zoyland, England. Jack writes, "This airfield was closed some years ago, but during the test flights of my Mustang, a guy who lives on the perimeter made his way to me and thanked me for the memories! It seems that during the War, Mustangs flew from this airfield, and the sight of my model with invasion stripes made this guy's childhood memories flood back. To my knowledge, only the USAF operated here. The place is now derelict, but the the tower still stands. I can sense the sound of those powerful Mustangs and wonder: are the oil-stains in the concrete a bit of Merlin remains?" Jack would love to hear from anyone who flew from this place, and he would love to see a photo of the airfield during its operational years. Contact him at 9 Summer Ln. N., Weston-Super-Mare, Avon, England BS22 OBD.

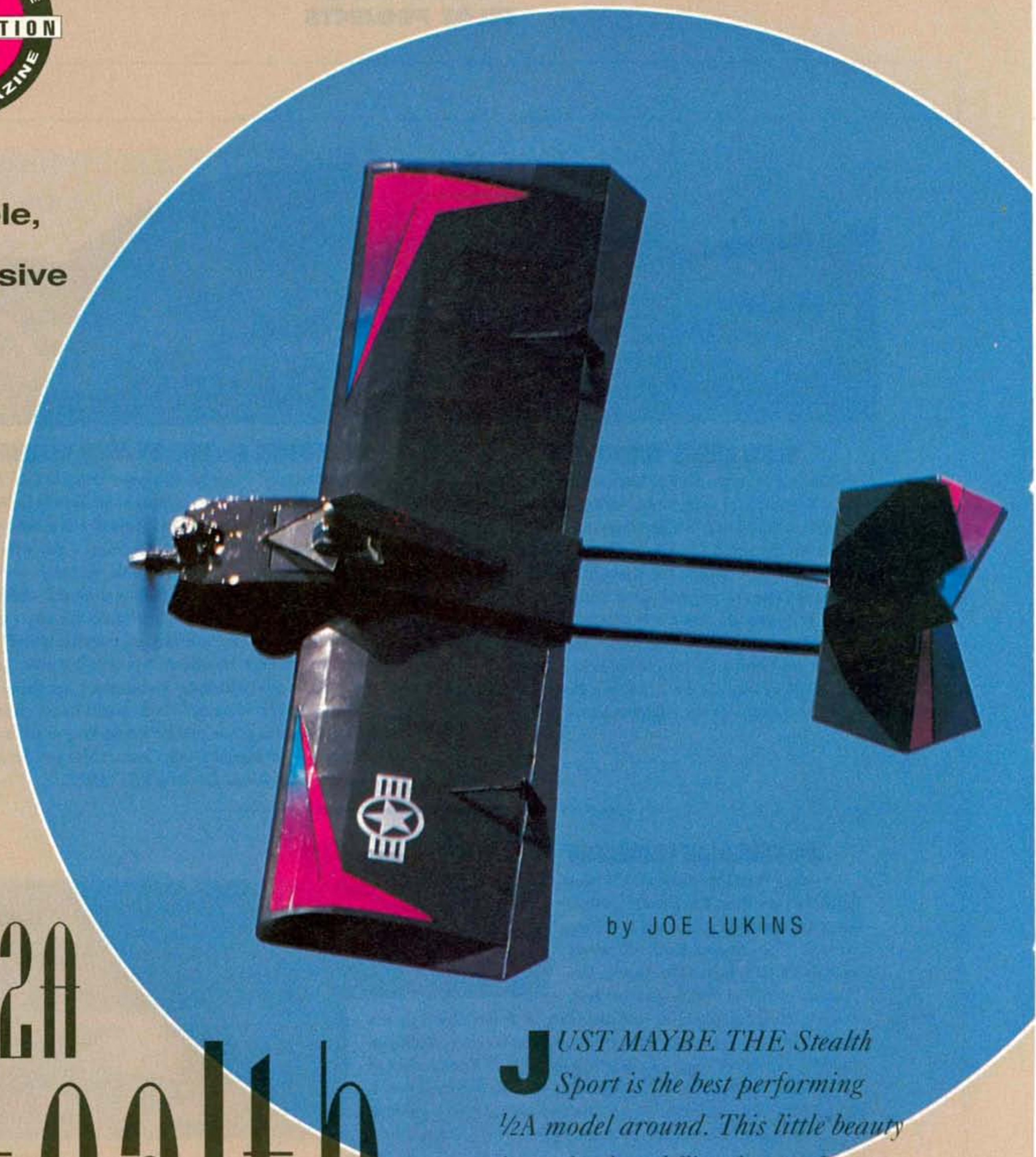
MACEDONIAN MODELERS

Yiannis Papadopoulos and Christos Parharidis are from Kavala and Drama, Greece, respectively. Yiannas is posing with his 77-inch span, K&B .40 power Canadair CL 215. Is that the Aegean Sea behind you, Yiannis? Remember how Icarus ended up plunging into that body of water? Don't fly too high! Christos's 110-pound behemoth is what happens when you multiply a Thunder Tiger Skylark by a factor of 3! The product of this equation is a 17-foot-span model that is powered by a Husqsvarna 120cc ignition engine. Yiannis writes, "I buy and read your magazine every month; I find it very interesting."

LA FAMILIA DE R/CERS

Model Airplane News subscriber Jose Miguel Ramos and his two-year-old nephew, Oscar, from Barcelona, Spain, are pictured here with one of Oscar's favorite planes, a Saito .65-power Tiger Moth. Jose writes, "When I go flying, I ask, 'Oscar, would you like to come with your uncle and the planes?' He quickly answers very excitedly, 'I uncle planes! I uncle planes!' It's very funny." Jose, we at *Model Airplane News* are sure you'll continue to be "patient Uncle Jose" when, in just a few years, Oscar will be excitedly exclaiming, "I, uncle, am a better flier than you. I, uncle, am a *much* better flier than you!"

Enjoyable, inexpensive flying



1/2A Stealth SPORT

by JOE LUKINS

JUST MAYBE THE Stealth Sport is the best performing ½A model around. This little beauty is a schoolyard flier that performs a bagful of tricks, yet it's as forgiving as most aileron trainers. Enjoyable, inexpensive flying was the lofty design goal, so when it cruised nicely, glided smoothly and landed with ease, that was it.

PHOTOS BY JOE LUKINS

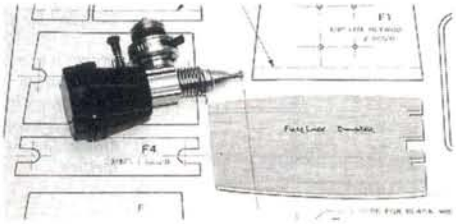
The high-tech, twin-boom design always draws a curious crowd, and interest really piques when they learn that a Cox* ½A reed engine supplies all the power that's needed for the Stealth Sport to effortlessly tote two standard servos, a standard-size radio and a 500mAh battery pack—all comfortably nestled in the "wide-body" fuselage! The Stealth builds your confidence fast; after a few warm-up laps you just gotta start loopin' and rollin'. If you're ready, try zooming up to a power-on stall into a moderate wind. This yet-to-be-named maneuver (an inverse, tail-slide, snap flop?) is a marvelous sight, and recovery is a breeze. How about inverted flight, inside loops and victory rolls? Yes, yes, yes!

At a recent flying session, a spectator and his son volunteered, "That sure is a nice model; it looks like something we could build and fly." We think this keen observation captures the essence of this project, but you should be able to solo a trainer before flying the Stealth.

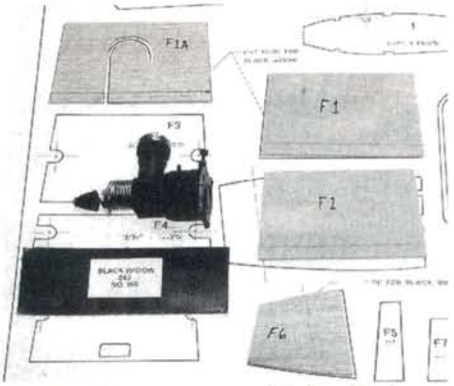
My son Randy piloted all of the test flights. Some were in desert winds where the Stealth Sport actually flew backward. The strength and integrity of the model received special attention. He rammed a palm tree going full speed at a 60-foot altitude! The airplane dropped straight down—as did our jaws! The only damage was a couple of hairline cracks in the balsa sheeting that we quickly repaired with Zap* adhesive. We attached a new prop, and we were ready to go again. (Should I have said "crack test pilot" or maybe "hair-brained cracks?") Anyway, we have flying proof than an 18-ounce Stealth is very durable. Top Flite* charcoal MonoKote is great for flight visibility and for "stealth," but before setting the plane in a dark corner, you may want to tie a bright orange banner to its tail. Sometimes it hides.

The exploded construction drawing makes the Stealth Sport a real treat to build. Here are some of the features:

• All the fuselage parts and tail booms are

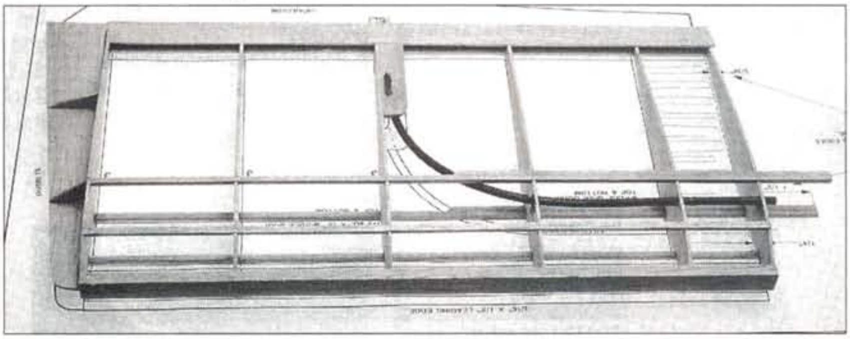


The fuselage side doublers for the Dragonfly .049 engine no. 4505 have to be shortened to the line indicated on the plans to accommodate its longer length.



If you want to power your model with a Black Widow .049 engine no. 150, the height of the F1 and F1A bulkheads must be trimmed to the lines indicated on the plans because of the forward location of the firewall.

STEP 1: Wing Panels



Here is the completed wing with an aileron Nyrod housing in place. Note that the leading and trailing edges as well as the main spars extend past the root rib. They key into the fuselage side.

Note that the top and bottom spars, trailing edges and Nyrod tubes all extend past the R1 rib.

1. Make four spars by gluing the doubler to the spruce spar.

2. Place wax paper over the plans, and pin the bottom spar and the trailing edge in place.

3. Zap the ribs to the spar and the trailing edge.

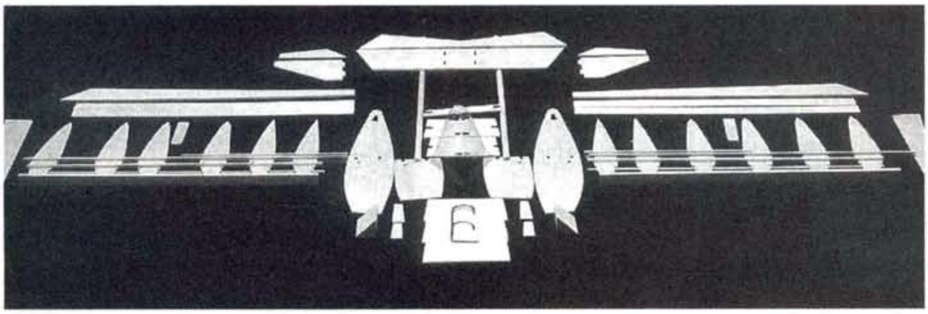
4. Zap the top spar, turbulator and trailing edge in place.

5. Zap the leading edge in place, and then add the tip and tip gussets.

6. Add the balsa Nyrod exit guide, and then install the Nyrod outer tube.

7. Remove the panel from the plan, Zap the bottom turbulator in place, add the cross-grain sheeting and then round the leading edge, using the plan as a reference.

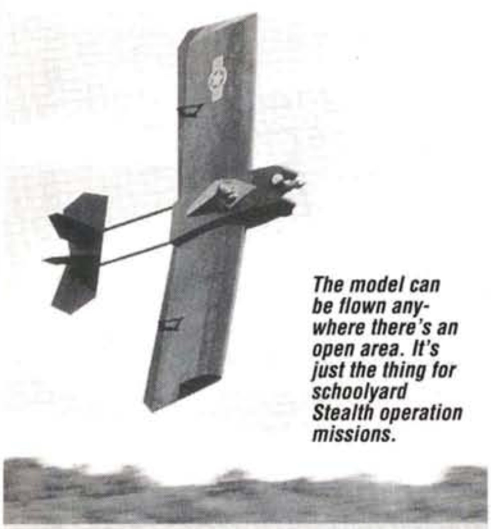
8. Repeat steps B through G for the other wing panel. Set the wings aside until you're ready to test-fit them into the fuselage.



Here are all the parts of our model. Scratch-building is nothing more than making all the "kit" parts first and then putting them together. Assembly is very fast.

SPECIFICATIONS

Type: sport fun-flying machine
Wingspan: 32 in.
Wing area: 252 sq. in.
Wing dihedral: 1¼ in. (each wing)
Weight: 18 oz. (with 500mAh pack)
Wing loading: 10.3 oz./sq. ft.
Engine: ½ A (Cox Dragonfly/Black Widow/QRC/Texaco/or for competition, TD 051)
Radio: prototype testing
• Futaba* 127DF with two S148 servos and NR4QB battery pack
• Cox Cobra Three with three 80111 servos and 225mAh battery



The model can be flown anywhere there's an open area. It's just the thing for schoolyard Stealth operation missions.

Aerodynamic Considerations of the Stealth Sport .049

Special efforts and numerous flight tests were made in an effort to make the Stealth Sport almost stall proof. Looking at the side cross section view, it is apparent that the center of lift of the fuselage is approximately two inches in front of the center of lift of the wing. The wing angle of attack is set two degrees positive with respect to the centerline, or angle of attack of the fuselage. As the wing approaches a more efficient lifting angle, it balances and dynamically corrects the aircraft towards stability.

Notice also that there is a significant amount of downthrust built into the engine alignment. This was necessitated because the propwash across the fuselage created excessive lift, and at engine off, the nose would drop, requiring immediate correction and full up trim to allow for uneventful landings. The downthrust negates the extra lift and makes the transition from powered flight to glide so slick that it's difficult to detect.

Both the ailerons and elevator are triangular in shape. This is a mechanical means of obtaining exponential response from the controls without using a computer radio. It tends to lessen the effect of small control inputs because a very small area is first to enter the slipstream. This results in precision tracking seldom seen in small, lightweight models.

STEP 2: Fuselage

Select your engine, then proceed:

■ For the Dragonfly engine, cut the fuselage doublers at the dashed line. All other parts are cut out using templates.

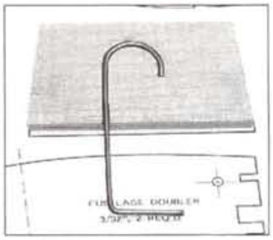
■ For the Black Widow, etc., parts F1, F1A and F6 must be cut on the dashed lines as shown. (Trim F5 to fit later.)

1. Carefully align and Slo Zap the fuselage doublers to the fuselage sides; be sure you make a left and a right!

2. Tape the fuselage sides together, with the doublers to the outside. Trial-fit the booms to the fuselage sides and hold them together with rubber bands. Once they're aligned, Zap a boom to each side.

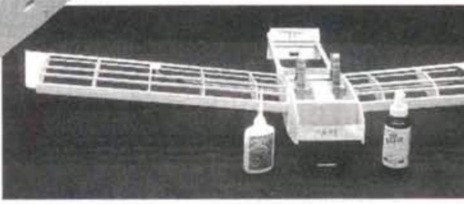
3. Build the "firewall sandwich" by gluing F1A to F1. Then place the landing-gear

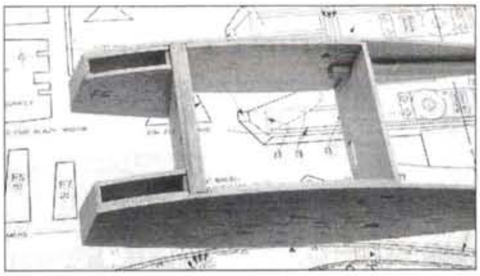
The fuselage sides and doublers are first glued together to make a left- and right-hand side. The completed sides are then taped together while the tail booms are held in place with rubber bands for a trial fit. When everything is properly aligned, the booms are Zapped into place.



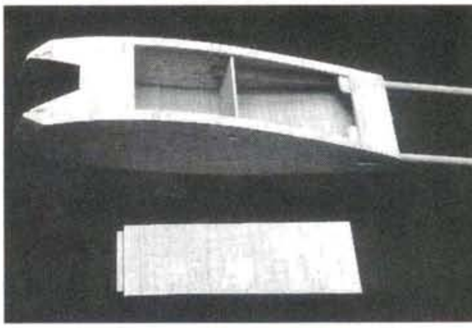
Start the construction of the firewall by gluing one of the F1 formers to the center F1A former. Then, fit the landing-gear wire into the slot in the F1A former.

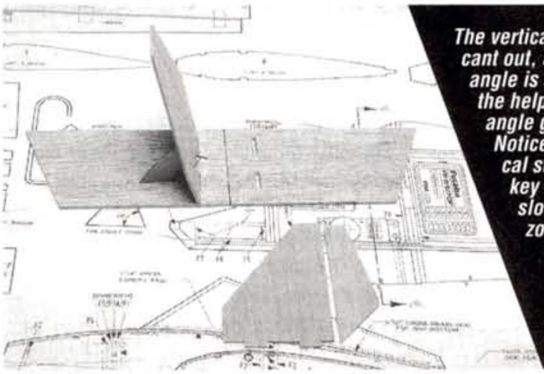
Trial fit the fuselage parts together with rubber bands and temporary building jigs.





Install the F5, F6 and F7 pieces to the engine compartment.





The vertical stabs cant out, and the angle is set with the help of the angle gauge. Notice the vertical stabs that key into the slots on horizontal stab.

STEP 3: Tail Group

1. Stabilizer: mark strips (about 3/16 wide) where the fins (top) and the booms (bottom) will be joined. Then cover the stab in sections, leaving the marked areas bare.

2. Fins: note the tangs

wire in the slot. Using plenty of Slo Zap, add another F1. When this has set, drill the holes for the engine, and install the 3-48 blind nuts.
4. Use rubber bands and masking tape to trial-fit the fuselage sides, the firewall, F3, F4 and temporary F3 as shown in photo.
5. Trial-fit the wings into the fuselage, and test-fit F2. Check the alignment of the wings and booms. *Now remove the wings and F2!*
6. Place the fuselage upside-down over the plans, and holding everything square, Zap it together.
7. Add F6 doublers. Add the two F5 nose pieces and the nose formers F6 and F7.
8. Add the top and bottom cross-grain fuselage sheeting. Top: don't glue F3 because the top hatch still needs to be cut and lifted out from it. Glue the top sheeting at all other contact areas.
Bottom: use the standard sheeting procedure.
9. Mark and carefully cut out

Trial fit the wings to the fuselage. When you're satisfied that everything is where it should be, remove the wings, place the fuselage upside-down on the workbench and Zap the parts together.

the top hatch, and then add the tang to the front of the hatch (see isometric). Add the two lite-ply cleats at the aft radio compartment.

Add the cross-grain sheeting to the top and the bottom of the fuselage. Don't glue the sheeting to the top of the F3 piece, because the top hatch is cut out of the sheeting and lifted out.

and the vertical grain when cutting from the $\frac{3}{32}$-inch sheet. Cover, leaving the tangs and the contact area bare.
3. Using a 70-degree guide, Zap the fins to the stab and add Slo Zap fillets.
4. Cover, hinge and install elevator.

"square-locked" in place with rubber bands and masking tape, then Zapped, and presto, the darn thing is almost built.

- A "firewall sandwich" (hold the hot sauce) contains the nose gear that's reinforced by the engine-mounting screws.
- Each wing half is built and covered before it's installed in the fuselage.
- The wing dihedral is automatically set by the angled fuselage sides.
- The wing spars are held by a "wing-span sandwich" that reinforces the structure.
- The tail group is assembled and covered before it's joined to the tail booms.

CONSTRUCTION

Before starting, you'll have to decide on which $\frac{1}{2}$A engine you are going to use, because various engine lengths require different firewall locations and thus, different fuselage doubler lengths. The plans show two setups: one for the Cox Dragonfly with an extended tank, and another for the Black Widow, QRC, or Texaco engines also by Cox. Any of them will give sparkling performance. We prefer the Dragonfly because of inverted flight capability and longer air times. (A Tee Dee 049 tank mount could also be fitted, but expect brief, laser-like flights.) If you'd like to practice for fun-fly competition, or race a few laps with a buddy, you'll find that there's room for a 1-ounce tank, a 225mAh battery pack and three small servos if you move the firewall farther forward to accommodate a T.D. radial engine mount.

Now review the photos, and go over the plans and instructions a couple of times and become familiar with the parts, especially the firewall and its location, the sides and doublers, and the three fuselage formers. Once you see how it all goes together, it's a cinch to build, and perfect alignment is guaranteed. While you'll often refer to the plans, they're used only for building the wings. The rest fits and locks together to form a sort of monostructure. As with all scratch-building, start by assembling the required materials, then cut and shape all the parts as though you were making a precision kit.

Our prototype Stealth Sport has a hundred flights by now, including an inverted landing and the infamous tree ramming, and it's still going strong. Good luck to you!

BALANCE

The balance should be very close with the equipment arranged per plan, but what if your Stealth doesn't balance on the wing spar when you hold it at the tips? First move the equipment and then, if necessary, add a little weight because performance won't be adversely effected. (Have you ever read that before?)

CONTROL SETTINGS

The triangular ailerons and elevator afford a mechanical means of obtaining exponential response from the control surfaces. The effect of small control inputs is dampened, because a very small area is the first to enter the slipstream. This results in precision tracking that's seldom seen in a lightweight model. At full commands the Stealth will perform surprisingly agile maneuvers. Aileron throws should be set $\frac{3}{16}$ inch up and $\frac{3}{16}$ inch down. Elevator throws should be set $\frac{1}{2}$ inch up and $\frac{1}{2}$ inch down.

FLIGHT PERFORMANCE

LAUNCHING / TAKEOFFS / CLIMB-OUT

Hand launches by the pilot are simple owing to its excellent speed range. The bottom of the fuselage is very easy for adult hands to grip, and it's easy to propel the plane forward briskly from only a walk. It climbs very well, and it quickly becomes a dot in the sky. If you know you need your glasses checked, this may not be the model for you.

LOW-SPEED STALLS

Stalls were exceptionally docile, and they reminded me how a much larger aircraft stalls. There's a very slight yaw stability loss through the stall that I attribute to the "low profile" twin rudders that are partially blanked out by the center section at high attack angles. There's ample control authority in the ailerons that keep the plane on course at speeds approaching the stall.

HIGH-SPEED STALLS

This was impossible to ascertain owing to the light wing loading and excellent flight characteristics. Only an overweight model of this design would be susceptible to a high-speed stall situation.

SPEED RANGE

The Stealth again exhibits the characteristics of a much larger model. It has a great speed range and it would be a lot of fun to try a "throttleable" engine such as the Cox .074. If you do, choose your throttle servo carefully, because all of the aircraft's wonderful characteristics will be lost if you add excessive weight.

AEROBATICS

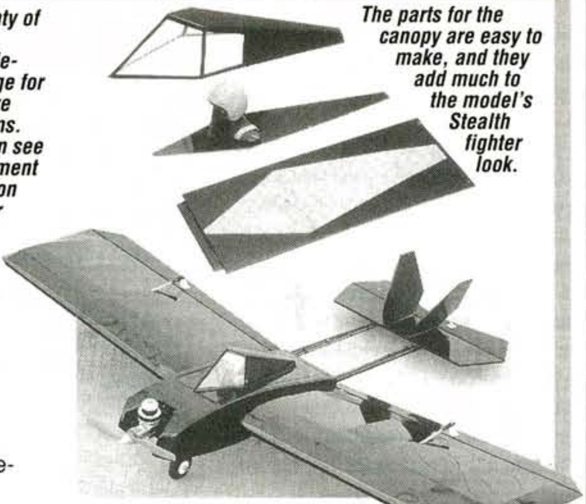
Aileron rolls are brisk and smooth. Loops are tight and true until the air speed is gone, and then they get slightly lopsided. Inverted was acceptable, requiring about 25 percent of down-elevator to maintain level flight. I attempted many different types of spin entries and was never able to do more than spiral. It's hard to complain about a plane that's too stable! The aircraft was very adept at Cuban-8s that were right down on the deck.

OVERALL

I know that there are those out there who don't consider it appropriate to call model airplanes "toys." If you feel this way, too, then you haven't *played* with a good .049 power model like the Stealth. This model is a double dose of fun, and it's small enough to fly anywhere there's open space. Owing to its lightweight, simple layout, this model will bounce through mishaps that would destroy larger, heavier models. Build yourself a Stealth and have a ball!

—David C. Baron

There's plenty of room in the model's wide-body fuselage for standard-size radio systems. Here you can see the arrangement for the aileron and elevator servos, battery pack and receiver.



The parts for the canopy are easy to make, and they add much to the model's Stealth fighter look.

The Stealth Sport is ready to go.

STEP 4: Final Assembly

1. Cover only the top and bottom of the fuselage, overlapping the sides by ¼ inch.
2. Cover the wings, leaving the face of W1 bare.
3. Zap the wing panels to the fuselage sides and Zap the spars to F3. Place Slo Zap on the front of the exposed spars, and then push F2 up flush. Dribble more glue around the perimeter of F2.
4. To cover the side of the fuselage, use a W3 rib as a template to cut a hole in the MonoKote. Slit the MonoKote at its trailing edge, set it in place on the side, iron it on and trim it to the final shape.
5. Cover, hinge and install the ailerons.
6. Cover the hatch and install the canopy using Poly Zap. Note: wipe the canopy with alcohol to remove dirt or fingerprints prior to gluing.
7. Zap the tail assembly to the booms and make Slo Zap fillets at the joints.
8. Remove temporary F3 former, and Zap the Nyrod guides to the inside of the tailbooms.
9. Install the radio and hook up the control surfaces.
10. Fuelproof the engine area and install the engine. Note: either remove the Dragonfly throttle sleeve, or hold it full open with a 1/32-inch wire hooked from a snap ring to a top engine bolt.
11. Install the nose wheel, and bend and install the 1/16-inch wire tail skids.
12. Set up and check the control throws.
13. Take a long, proud look at what you've built; does it look like a fun-flying machine or what!

STEALTH SPORT

FLYING

With the radio on and the .049 humming, give the plane a nice firm toss with the nose just above the horizon. Once it's trimmed, you won't need any controls for a straight-out departure. After a flight or two, really crank it around, and don't forget to stop in for an ounce of fuel every 5 minutes or so! Happy flying—enjoy!

**Here are the addresses of the companies mentioned in this article:*
***Cox Hobbies,** 350 W. Rincon St., Corona, CA 91720.*
***Zap-a-Gap;** manufactured by Pacer Technology and Research, 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730; distributed by Frank Tiano Enterprises, 15300 Estancia Ln., W. Palm Beach, FL 33414; Robart Mfg., P.O. Box 1247, St. Charles, IL 60174; House of Balsa Inc., 10101 Yucca Rd., Adelanto, CA 92301.*
***Top Flite MonoKote;** distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*
***Futaba Corp. of America,** 4 Studebaker, Irvine, CA 92718.* ■

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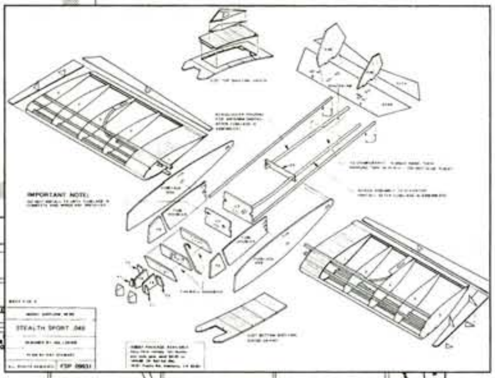
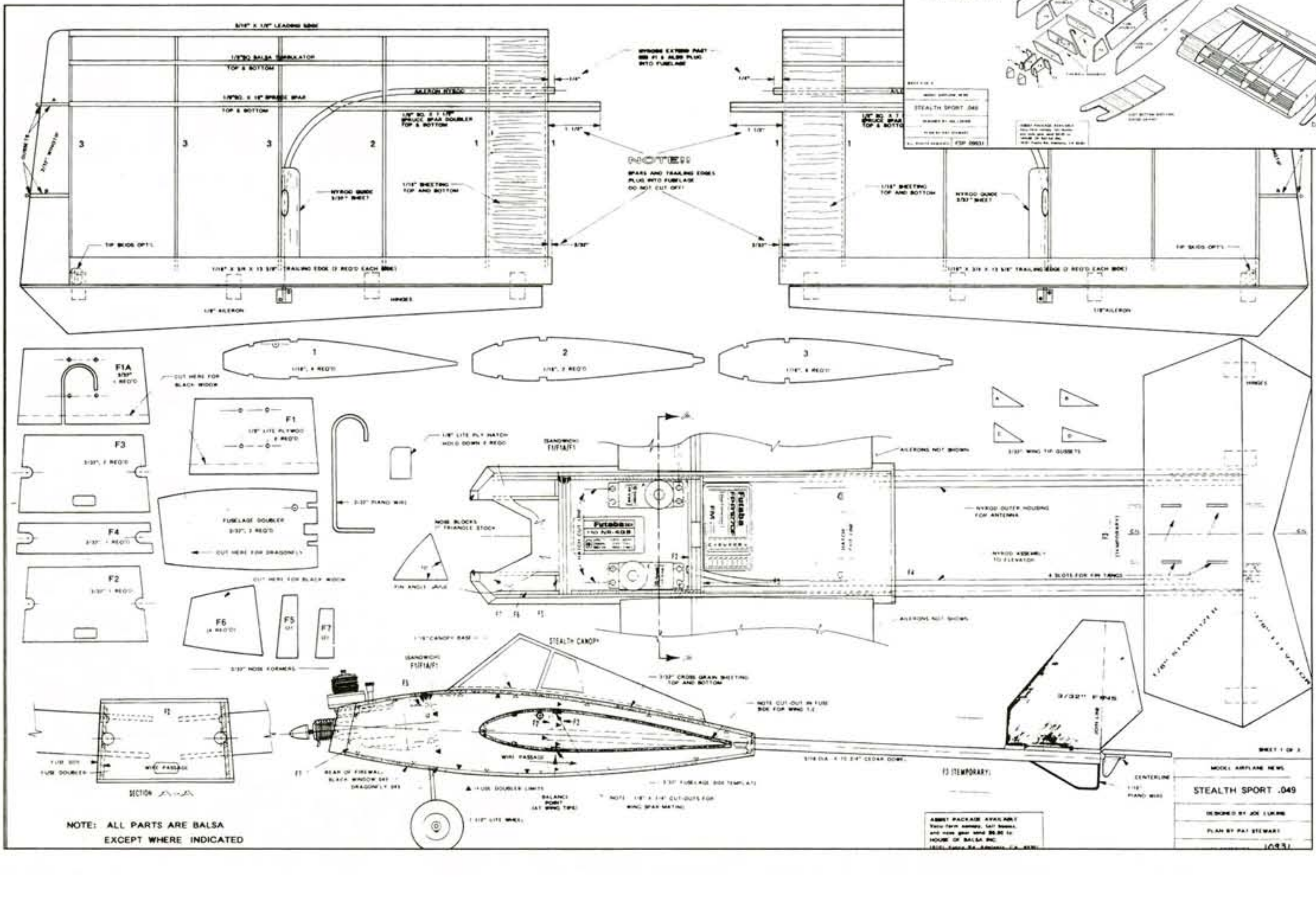


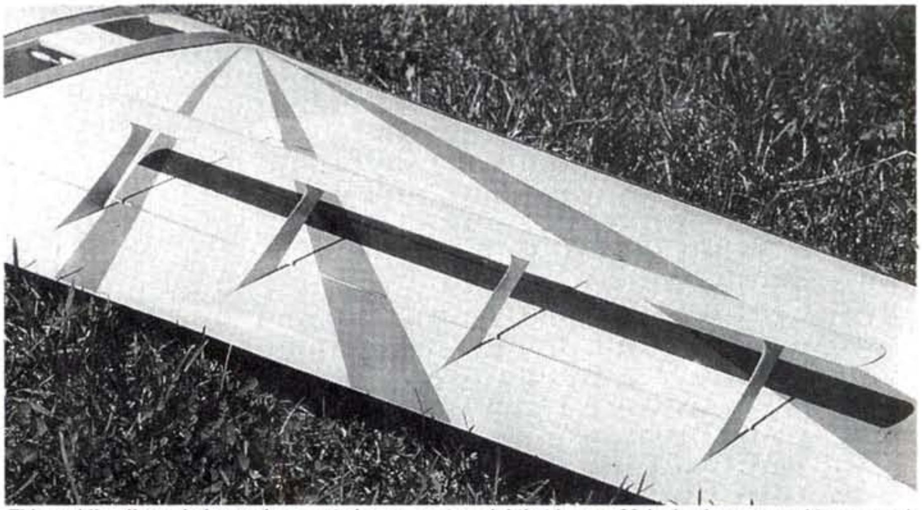


PART 2

HOW TO

Labor-Saving Devices for Overworked Servos

by CARL RISTEEN



This paddle aileron balancer is mounted on a sport model that has an 86-inch wingspan and is powered by a piped Webra 120. One normal-size servo provides a 1,230 square-inch wing (with 4-inch chord ailerons) with a roll rate of more than 360 degrees per second. Paddle balancers are plywood, and they also function as mass balancers for ailerons to help prevent flutter.

Editor's note: in Part 1 of this series, Carl Risteen offered valuable tips on linkage mechanics, servo torque loads and servo throw adjustments applicable to the control systems on larger models, or models with higher wing loadings (this included a method for predicting the required servo torque for a given application). Part 2 concludes with a fascinating discussion of aerodynamic servo-boost tabs. These tabs preserve servo life and enable you to use smaller servos for larger "jobs" (and therefore reduce cost and weight). They also offer exciting new performance possibilities. We think this is a "must read."

EXCESSIVE CONTROL FORCES gave the full-scale aviation people a lot of headaches (and sore muscles) in earlier times, prompting experimentation with various balancing and boost systems. The sheer muscular effort needed to fly some of the larger aircraft could be exhausting, particularly in rough air when the controls had to be manhandled about constantly to maintain an even keel. The very notorious WW I Barling Bomber, a multi-engine triplane, required two very strong pilots to wrestle in unison with the dual controls.

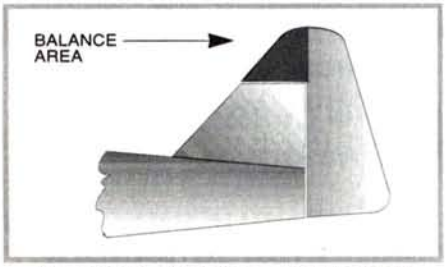


Figure 5. Tip Balance Rudder

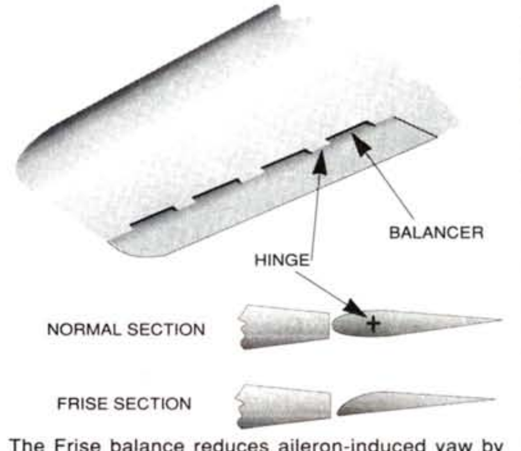
Various schemes were tried in attempts to make the pilot's job less physically arduous. Most of these attempted to use the tremendous energy available in the slipstream to assist in moving the control surfaces. These approaches fell into two general categories: aerodynamic balancers and auxiliary servo, or boost surfaces. (Hydraulic assist, a partner of the automatic pilot, was still in the future.)

The school of hard knocks weeded out many of them, some of which were downright dangerous. Modelers can benefit from the toil of earlier designers by applying their more successful efforts to giant-scale models. These models may work their servos even harder than many early large aircraft strained their leather-helmeted aviators!

AERODYNAMIC BALANCERS —PROS AND CONS

These are devices intended to reduce the torque required to move the control surface by placing the center of aerodynamic pressure closer to the hinge line. This gives the control surface less servo-fighting leverage. The simplest way to do this is to place some control surface area ahead of the hinge line, frequently at the tip of the aileron, elevator or rudder (as shown in Figure 5). Tip balancers are reasonably effective, but they also have disadvantages; they can cause an undesirable twisting force to be exerted on the control surface a long way from the control force input, and that can result in flutter.

Placing area ahead of the hinge line over much of the length of the control surface eliminates the twist and was used on quite a few aircraft (see Figure 6). An example is the rudder of the venerable DC-3. This is a much more expensive fix, in terms of structural complexity and weight. It can reduce control forces by up to about 80 percent; but it can also cut control effectiveness in half at large



The Frise balance reduces aileron-induced yaw by projecting a sharp lower edge into the slipstream. This creates additional drag on the wing with the raised aileron to counteract the drag of the wing with the lowered aileron. The hinge line on both a normal and Frise balancer should be located about 25 percent of the control surface's chord behind its leading edge.

A paddle balancer should be of a fairly high aspect ratio. Position it as far ahead of the hinge line as is practical. It should be a symmetrical airfoil that's aligned with the relative slipstream. It will require incidence of about 3 degrees on the ailerons, zero on the rudders and 1 to 2 degrees on the elevators.

Figure 6. Distributed Aileron Balance

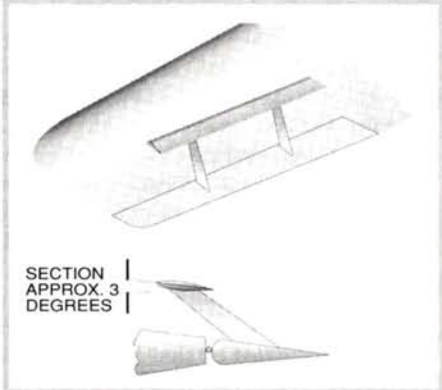


Figure 7. Paddle Balancer

deflections, when the balance area protrudes outside the gap and produces a very large gap that leaks a Niagara of air.

STABILATORS

A variation of this scheme is the all-moving tail, also called a stabilator or flying tail. It eliminates the draggy, leaky hinge line entirely; adds little weight and cost; and is quite commonly used today on aircraft of all sizes and performance categories—from light planes to supersonic fighters. An all-moving tail will not develop as high a peak control force as a separate stabilizer and elevator combination that will form a deeply cambered airfoil when it's deflected. Such airfoils produce much higher maximum lift coefficients. Slots and inverted airfoils are sometimes used in flying tails to make up for the peak lift deficiency, and they produce the necessary download for landing with a forward CG position.

An aerodynamic servo-assist boost tab on the rudder of an 84-inch biplane. One normal-size servo provides 45 degrees of throw at over 90mph; this slams the airframe about 45 degrees sideways. It's great for knife-edge square loops and hot-dogging.

Balancing schemes that place area ahead of the hinge line have their limitations. I have found this particularly bothersome with rudders. At large deflections, the center of pressure moves aft considerably, making the balancing surface less effective just when it's needed most. Moreover, a balancing area that is large enough to balance the control surface at large deflections may place the center of pressure *ahead* of the hinge line when the control surface is centered. This can result in a very unhappy, nervous control surface that's impossible to trim at best, and, at worst, may get into serious oscillation or flutter.

PADDLE BALANCERS

Paddle balancers are airfoils—small auxiliary wings—that are attached to the control surface by pylons that lean ahead of the hinge line (see Figure 7). They make great conversation pieces at the flying field, but they're seldom used today. (Nonetheless, they can be much more effective than the counterbalance area more commonly seen at the tip of a control surface.) They impose a drag penalty, but on the positive side, they don't produce a leaky hinge line like that of the DC-3's rudder, which tends to kill control effectiveness.

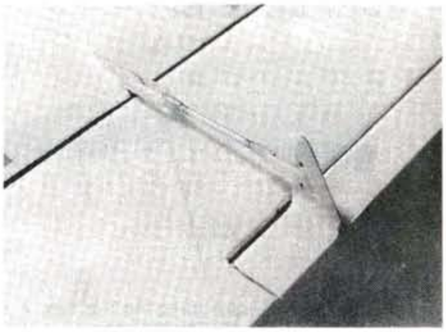
A small, unnoticed incidence error in the paddle balancer can produce a serious out-of-trim condition that will increase with air speed and require some kind of adjustment for incidence (or trim tabs). I found that paddle balancers were very helpful in producing prodigious roll rates on three large models. They also provide mass balancing against flutter—a good excuse for making them heavy and rugged. I have since abandoned them in favor of servo or boost tabs.

AERODYNAMIC SERVO/BOOST TABS

Frequently called boost tabs in the full-scale world, these are the best aerodynamic balancing devices I have found thus far. They're relatively unobtrusive, unlike the odd-looking paddle balancers, and produce little drag. Introduced in the 1920s these small, auxiliary control surfaces are mounted in the trailing edges of the main control surfaces, just like oversize trim tabs. Unlike trim tabs, however, they're actuated by a linkage that moves them in opposition to the control surface.

For example, when an elevator moves to the "up" position, the boost tab moves "down" and tends to lift the trailing edge of the elevator—thus assisting the servo. The farther the elevator moves, the farther the boost tab moves in the opposite direction to counter the increasing aerodynamic force that opposes the elevator's motion (see Figure 9). The result is a nearly linear assist (almost like hydraulic boost) that's far more effective than putting balancing area ahead of the hinge line, particularly at large deflections. Boost tabs can be retro-fitted without great difficulty to perk up sluggishly responding models. Thanks to boost tabs, one of my large models needed only one servo on the ailerons to get twice the roll rate that two servos had previously provided.

The degree of assist is adjusted by varying the relative travel of the boost tab to that of the control surface. This can be accomplished by experimenting with various linkage holes



This aerodynamic, servo-boost tab is fitted on the aileron of an 84-inch-high performance biplane. The tab enables a single, normal servo to provide twice the roll rate that was previously provided by two servos.

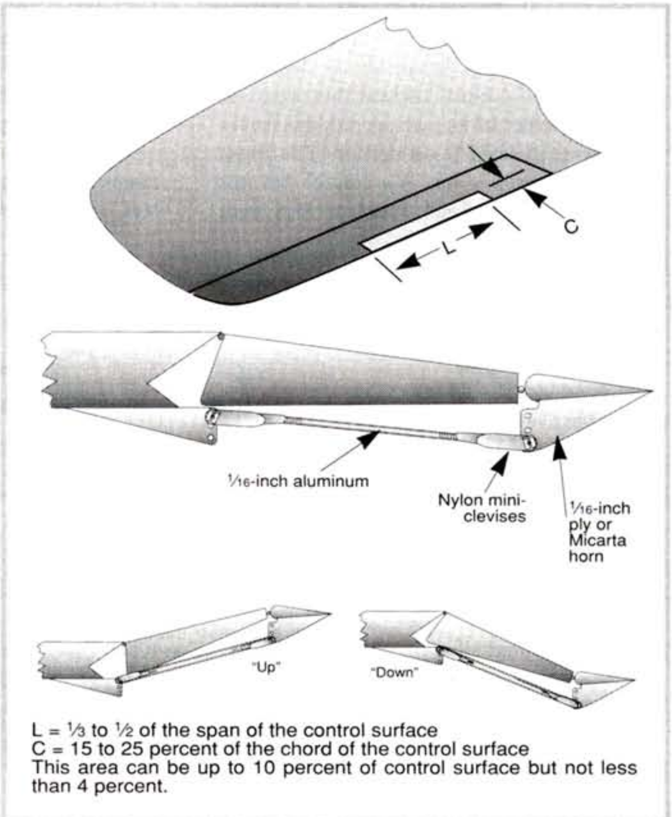
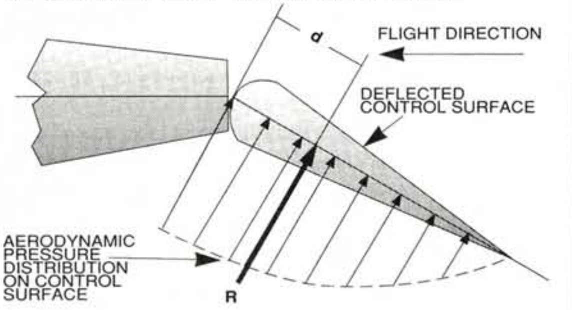
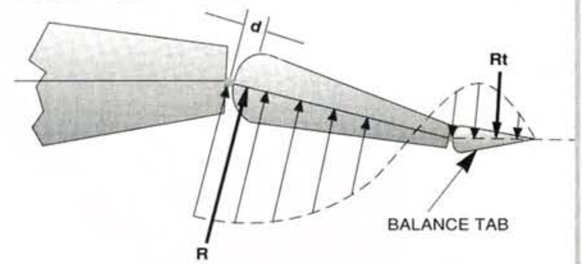


Figure 8. Aerodynamic Servo-Assist Tab

This diagram shows how a relatively small balance tab can have a very large effect on control-surface torque.



"R" is the resultant force that's equivalent to a single force acting at distance "d" from hinge line. Control surface torque at hinge line = Rxd



"R_t" is the resultant force on the tab. A relatively small force R_t acts near the trailing edge (much farther from the hinge line), and this moves the overall resultant force "R" much closer to hinge line. This also slightly reduces the magnitude of R so that more control-surface area is necessary to develop the same control force.

Figure 9. Effect of Balance Tab on Control-Surface Torque

in the control horns. It can also be overdone, resulting in a control surface that wants to move off center of its own accord; this forces the servo to hold it on center. The most noticeable result of this is a control that just won't trim, as the control surface flips from side to side within the free play that's present in even the tightest linkage.

HOW LARGE?

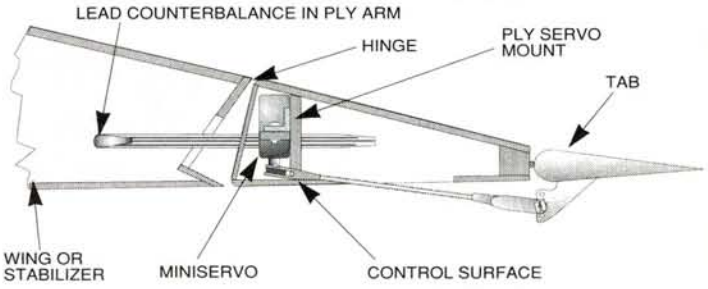
The boost tab should normally have a chord of less than 25 percent, and an area between 4 and 10 percent of the control surface. About 6 percent seems to be a good compromise. If very large angular deflections are required of relatively wide chord ailerons, the boost tab area should be close to 10 percent. I discovered this recently as I fine-tuned a new sport design that was intended for fun-fly aerobatics. The boost tab can be made full span without using an impractically small chord—just reduce the throw considerably. I've used full-span boost tabs on rudders; at 10 percent of the rudder chord, the throw needed for optimum balance was only about half that of the rudder itself. It's best to start with too little movement—just to be on the safe side—and gradually increase it until you have solid control response.

SERVO-OPERATED BOOST TABS

A super-effective variation of the boost tab is used on a number of large full-scale aircraft. The control system is connected directly to the boost tab, and it doesn't directly move the control surface, which is counterweighted and left free to weathervane in the slipstream. Movement of the direct-operated boost tab causes the control surface to change its angle relative to the slipstream and provides the necessary control force. The result is an extremely large multiplication factor between the force exerted by the pilot and the effective force on the control surface. This enables a big, fast aircraft to be flown easily without hydraulic assist.

The Douglas DC-8, for example, uses manually operated boost tabs on the elevators, connected directly to the control column by cables. This avoids the complexity and weight of hydraulic assist and gives light control with an excellent feel. Many DC-9 pilots joke that the "DC" stands for "direct cable." Both the ailerons and the elevators are operated by simple, reliable, cable-connected boost tabs and have no hydraulic assist in normal operation. Even the rudder on this beautifully handling big bird can be tab-operated manually, should the hydraulics fail. The ailerons and rudder on the larger DC-8 can also be manually controlled by similar boost tabs, if necessary.

With direct-operated, aerodynamic boost tabs, standard model servos could probably handle some light full-size aircraft. Indeed, some homebuilders *[editor's note: builders of lightweight "homebuilt" aircraft]* use model servos to provide the convenience of electrically operated trim tabs at a low cost. I haven't as yet tried them on a model, because the conventional boost tabs, slaved to the control surface, have proven entirely satisfactory. A really large, very fast model could benefit from the tremendous assist available. A separate servo would obviously be needed for steering control via the nose or tail wheel while taxiing.



Detail of a direct-servo controlled tab for very large models (This is from a large model design currently on the author's drawing board.) The servo torque has been multiplied more than 200 times. (A 25 ounce-inch servo could provide up to 5,000 ounce-inches of torque to the control surface, thanks to very large aerodynamic assist.) Access to the servo is through the leading edge of the control surface (after removal). To avoid needing upper and lower external counterbalances to get the CG reasonably close to the hinge, an internal counterbalance is used. A single, external counterbalance under the surface may lower the CG too much and result in unwanted control-surface movement (owing to horizontal acceleration). Note the drag-reducing hinge gap.

Figure 10. Direct Servo-Controlled Tab

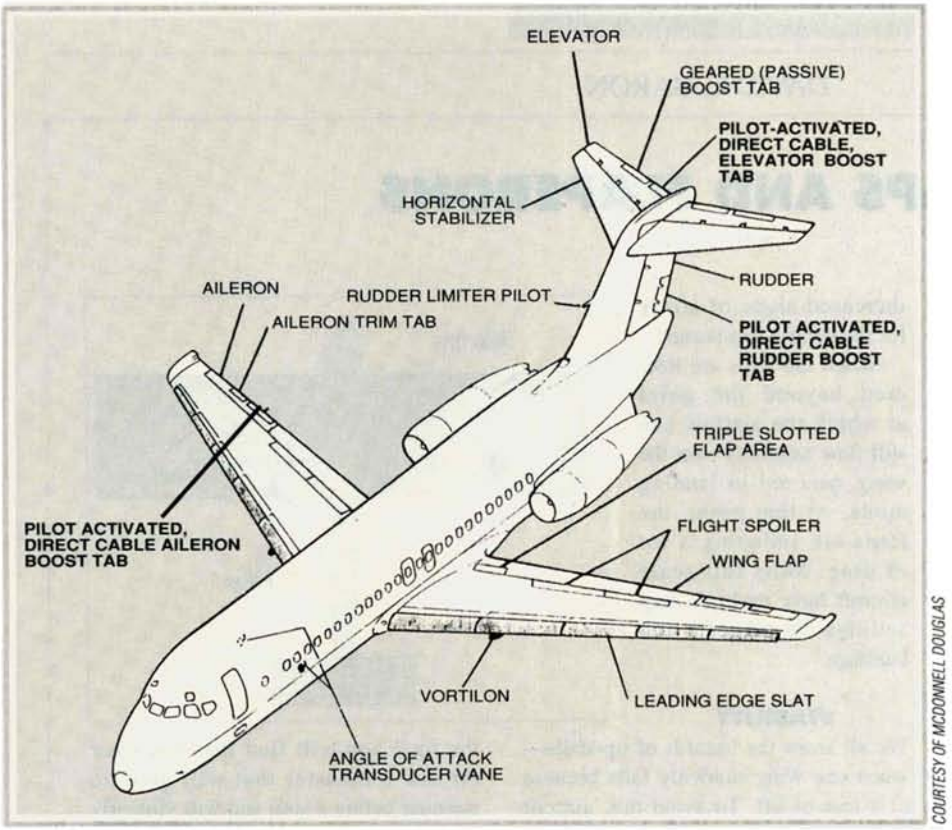
ACTUATING LINKAGE FOR DIRECT BOOST TAB

The actuating linkage for a free-floating control surface with a direct, servo-operated, aerodynamic boost tab could be a bit tricky. The simplest solution may be to mount a miniservo in the control surface itself, the way homebuilders do for electric trim. The servo should be mounted as close to the hinge line as possible to minimize the additional mass unbalancing that will result from the weight of the servo. Run the servo lead across the hinge line, taking great care to get a gentle flex pattern in the lead to minimize fatigue. A mass counterbalance may not be absolutely essential, but it will prevent excessive drooping of the control surface, and it will certainly help prevent flutter.

Partial-span boost tabs on tapered control surfaces should be located near the maximum chord for best results.

TRIMMING WITH BOOST TABS AND TRIM TABS

Initially trimming a new model may take a little longer with boost tabs, because they also act as trim tabs and must be carefully adjusted to the optimum center position. If they aren't,



DC-9 Flight-Control Surfaces

they'll tend to force the control surface off center as air speed increases, putting the model out of trim. Unless the model has some unintentional misalignment or warp, the boost tab should be exactly centered in the control surface in the neutral position. Usually, only a very minor adjustment is needed to get the trim zeroed in.

Sometimes, a model with conventional control surfaces can't be satisfactorily trimmed owing to stabilizer incidence error or a wing warp. The model can be trimmed at full throttle and out of trim at part throttle, and vice versa. For example, consider a model with a wing warp. The model is trimmed at part throttle by applying aileron trim against the warp. Because the aileron and its control linkage are flexible to some degree, as the air speed is increased, the aerodynamic load trying to center the aileron increases greatly. The aileron is forced slightly off its correct position, and the model is out of trim.

The only cure for a model that doesn't have boost tabs or trim tabs is fixing the warp. This can be difficult with fully sheeted wings, but a boost tab can come to the rescue. Adjusting the boost tab slightly off center will make it act just like a trim tab; it will keep the control surface at the same angle, regardless of air speed. Actually, most high-performance or large-scale models I have flown could have benefited from the use of trim tabs, because no model can be built perfectly true with exactly correct stabilizer incidence.

Trim tabs can be as simple as a small piece of soft sheet aluminum projecting from the trailing edge of the control surface (similar to those seen on some older light aircraft).

TRIM TABS AND SERVO LOAD

Another nice feature of trim tabs is the elimination of nearly all servo load except during maneuvers; this reduces the current drain on the airborne battery. This is particularly important for the hard-working servos in large models. With aerodynamic boost tabs, of course, you don't need trim tabs. The same tab willingly does both jobs—trimming and servo assist. I seldom use anything much bigger than an 800mAh pack in my biggies, unless they have a lot of extra servos, and I get tired long before the battery pack does. The ball-bearing, coreless-motor, high-power, pattern model servos are much lighter than big, ¼-scale servos. With the help of aerodynamic servo boost tabs, they do the job very well.

One thing to watch out for on all control surfaces is chordwise warps. These are frequently encountered in sheet-balsa control surfaces where the iron-on covering has shrunk more on one side than on the other. The resultant warps produce unwanted camber. I always check such control surfaces with a straightedge. If the camber is off, a little heat and force usually do the job.

Camber on a control surface will act just like a deflected trim tab, and it tends to force the surface away from the desired position. A barely noticeable camber can make a model impossible to trim well.

KEEP BOOST TABS AND LINKAGE LIGHT

The weight of boost tabs and their actuating linkage should be kept as low as possible. Excess weight on the trailing edge of a control surface can invite flutter. I like to use lightweight 1/16-inch bare aluminum welding rod in place of the more common steel linkage rods, as the loads are quite small. Threading long music wires through all the hinges on a control surface (after removing the stock pins) greatly facilitates building and covering, not to mention crash repair, because the control surfaces can be easily removed. Sharpen a long music wire at one end, and bend it 180 degrees. Insert the sharpened tip in the wing, stab, or control-surface tip (whichever tip is handiest) for retention.

CONCLUSION

If you've been struggling with overloaded servos on a giant-scale model, slaved boost tabs (as described above) are well worth a try. They'll reduce the load on the servos by about 85 percent. Direct, servo-operated boost tabs, although they're a bit more complicated, open up new vistas of really gargantuan, high-power models with tiny servos providing all the control response the pilot could desire. Many early WW II heavy-bomber pilots who were forced to wrestle with unassisted controls would have found direct-operated boost tabs a godsend as they nursed their bent and broken machines home.

Millions of hours meeting the precise control demands of airline service is evidence that the McDonnell-Douglas flight-control systems designers deserve an "A" for their efforts. We modelers might find this relatively simple system worth a try on our own "heavies."

ACKNOWLEDGEMENT

The author would like to acknowledge Ken Baker's helpful advice. Ken is a former Air Canada heavy-jet captain, a full-scale prop warbird pilot and a noted model enthusiast.

■

SIMPLE PROGRAMMING

DAVID C. BARON

FLAPS AND FLAPERONS

THIS IS THE first in a series of articles about stock functions that are often built into 6-, 7- and 8-channel programmable radios. You may have wondered: why have most manufacturers chosen these features to be permanent, and how do they work? What can be done with them to improve your aircraft's (and your own) flight performance? This installment discusses the use of the flap function for models that have (1) dedicated flaps or (2) strip ailerons doing double duty as "flaperons" via the flaperons radio function.

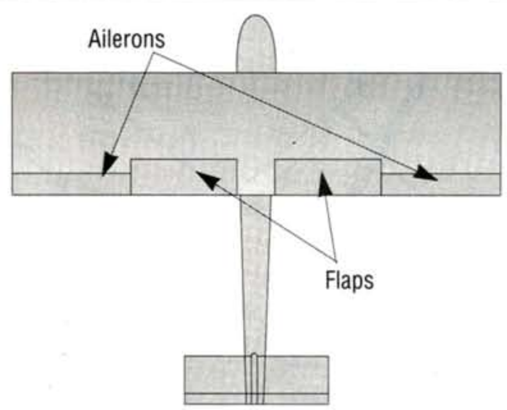
B approximates the angle of attack that the section of the wing creates when the flaps are lowered. The rest of the wing is represented by angle A.

ABOUT FLAPS

The most common full-scale wing configuration uses outboard ailerons and inboard flaps. Flaps have two functions. When extended in small amounts, they produce added lift for assisting takeoffs and slow flight. Larger deployments produce more drag than lift and are used primarily for shorter, steeper approaches and reduced landing distances. Models can use them in exactly the same manner.

When the flaps are lowered, they create additional lift by creating an increased angle of attack for the wing's flap section.

When the flaps are lowered beyond the point at which the airflow can still flow smoothly over the wing, you are in landing mode. At that point, the flaps are inducing a lot of drag. Most full-scale aircraft have multiple flap settings for takeoffs and landings.

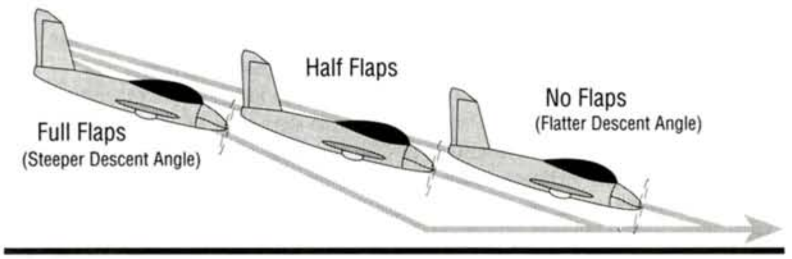


STABILITY

We all know the hazards of tip-stalls—when one wing suddenly falls because of a loss of lift. To avoid this, aircraft designers want the stall to begin at the wing's inboard section. This maintains aileron control and, hence, roll stability of the aircraft throughout a stall. This is also why so many full-scale aircraft as well as models have washout built into the wings. This is done to avoid violent stalls, stall/spin situations and tip stalls.

By locating the flaps inboard, you can guarantee that the outboard ailerons are at a lower angle of attack (relative to the ambient airflow) than that of the deployed flaps. Stalls are always determined by the angle of attack, so it's almost guaranteed that the inboard section of the wing will stall first. If you ignore this concept, and droop the ailerons of a Piper Cub (or any other aircraft that has ailerons far out toward the tips) you will find that you have created a monster that will give no warning before a stall and will violently drop one wing when a stall occurs. For this reason, you should only use flaperons on a model that has full span (or strip) ailerons.

For the same reason, you should never convert the ailerons to flaperons on a model that uses outboard ailerons (and no inboard flaps, such as a J-3 Cub). Lowering flaps in this configuration would result in the wingtips stalling first, and the recovery could end up in the ground.



Effects of Flaps on Approach Angle and Landing Point

FLAP SETTINGS

All aircraft are different, but a good setting for landing may be 30 to 45 degrees of deflection. A reasonable setting for takeoff assistance is about 10 to 25 degrees. All aircraft have different needs, but experimenting can be fun and safe. You should take off or land when you are testing flap deployment angles. Take the aircraft up to a comfortable altitude (at least two mistakes high) so that you have enough room and time to retract the flaps in case the aircraft is not flying comfortably.

PREPROGRAMMED FLAPS

Preset amounts can be comfortably programmed in using the built in flap-

USING TWO SERVOS FOR AILERONS

If your aircraft has full-span, or "strip" ailerons, i.e., without separate flaps, and you want to explore the advantages of flaps, the following simple method will help you convert your ailerons to "flaperons." First, you will need one servo for each aileron, because one servo can't lower both surfaces as flaps while still allowing them to function as ailerons. Consult the diagram for one method. By positioning the servos side by side, you can usually modify an existing wing with little trouble.

The servo that controls each control surface will need to be plugged into its own port in the receiver. (See the details below to find which radio requires which port.)

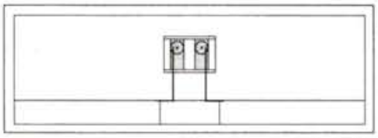
Before you start programming, be sure that the aileron servo that is plugged into the aileron port travels in the correct direction when you move the transmitter stick. Correct if necessary, using your transmitter's reversing function. Follow the same procedure with the flap servo. Plug it into the flap port in the receiver and ensure that it travels in the correct direction when the "Flap" knob, lever, or switch is moved. Correct if necessary.

Activate the Flaperons function on your radio. When this system has been activated, note how the flaps and the ailerons interact and how both ailerons still move when the aileron trim is moved.

ACE* MICROPRO 8000

Begin by setting the Left Aileron Neutral Position in the CH-7 calibrate menu (Sec. 3.3n.1). Next, it is necessary for aileron differential to be enabled. This is done by toggling right to "ENABLE A. DIFF?" and clicking the Option button. The next display will show "AIL. DIFF? (Y) N." Toggle to "(Y)" and press the Option button. Save your choices by toggling right to "SAVE NEW VALUES," clicking the Option button, toggling to "(Y)" and clicking again. Before continuing, return to the "RUN" mode, and test the direction and travel limits of the servo.

Next, we will use the programmable mixing capability and assign channel 6 as the flap channel, and assign both "CH-7" and "AIL. (CH-2)" to it. Channel 6 would be the "from" channel in both cases. Use mixers that are all on the same switch, such as 1A and 1B. The zero mix point must be 100 percent. Set the "DN/LT" percent of each mix to the desired



amount and direction of travel. It is suggested to start with 100 percent and experiment. Another option is to mix the elevator to the flap channel (using mix 1C) to give trim compensation when flaps are deployed.

AIRTRONICS 660

Using the "EDIT" key, scroll to screen 2. Cursor (>) to the "WING-TYPE" function and turn on "SPOIRONS." Don't be confused by the term spoirons (spoilerons). They are just flaperons that need their flap direction reversed! The servos must be plugged into ports 2 and 6 in the receiver. Install servo linkage as indicated on page 62 of the Infinity 660 instruction manual.

FUTABA 7UAPS

Use your Mode Select keys to get to "FLPR" (flaperons). First, you will need to activate the mode/function using the Data Input keys. Using the Cursor keys, go through each section of the function, establishing direction of motion and percentage of throw. I suggest that you use 50-percent flap authority to start. Leave the ailerons at 100 percent. The servos must be plugged in to ports 1 and 6 of the receiver.

JR (X-388S and X-347)

In the Model Setup mode (accessed by holding down both "MODE" buttons simultaneously and turning on the radio), scroll through the options until you arrive at "WING MIXING." Press the "+" key until you see "FLPR" (flaperons). To adjust throw volumes, return to the Model function mode by pressing the two "MODE" buttons twice. The travel adjustment (endpoint adjustment) will now show the ailerons separated as "L" and "R," and you will need to hold the stick to the left or right, respectively, to modify either direction. The same is true of the flap throw settings. The servos must be plugged into the receiver's ports 2 and 6 (aileron and Aux. 1).

Flaperon control expands the flight envelope of your model considerably. You'll wonder how you got along without flaperons!

elevator mix in your radio. In the case of the Airtronics* 660 or the Futaba* 7UAPS, it is referred to as 6-2 mixing. In the JR* X-347 and X-388S, it is the LD, or landing attitude, setting.

These built-in flap functions give you the same settings every time. Flap deployment commonly causes an aircraft to go out of trim with either a nose-up or nose-down condition. All the radios listed above offer a system for proportionately re-trimming the elevator to compensate for the flap-deployment angle selected. Once you know which way the plane tends to go when its flaps are deployed, you can program the necessary percentage of elevator trim to keep your airplane in level flight throughout flap deployment.

Full-span aileron/flap arrangements are fun, predictable and safe as long as you do not exceed a reasonable amount of flap deflection. (If you do, drag becomes an issue, as noted above.)

Modelers who want maximum maneuverability will often mix elevator commands to the flaperons. This produces a system that droops the flaps with up-elevator and raises them with down-elevator. This system is very popular in "U" control, but many full-scale aerobatic aircraft, such as the Acrostar and the Ultimate Bipe, use it also. For a starting point, I would suggest using half as much flap deflection as you have elevator deflection.

REMEMBER

Always experiment first with slow-flight performance. See how the plane behaves in stalls—at all flap settings—before attempting to try your flaps close to the ground. You will be pleasantly surprised at the improved control when you arrive at the right combination for your plane! Enjoy, and happy landings!

**Here are the addresses of the companies mentioned in this article:*
Airtronics Inc., *11 Autry, Irvine, CA 92718.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
JR Remote Control; *distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821.*
Ace R/C Inc., *116 W. 19th St., Box 511C, Higginsville, MO 64037.*

by JEF RASKIN

DIAMONDS IN THE SKY

Subject: *an overview of the various forms of R/C model flying.*
Source: *Academy of Model Aeronautics, 5151 E. Memorial Dr., Muncie, IN 47302.*
Summary: *some fascinating models are in this dated and overwritten account.*
List price: *$19.95.*
Approximate length:
31 minutes.

Produced in 1986, and showing its age a bit, this tape is a useful introduction to the wide variety of R/C airplane models. It could be used in a K-12 classroom or new-member welcoming situation. More experienced fliers know all this stuff, but they'll still find their eyes glued to the screen, because some magnificent models are flown very well indeed.

We see giants such as a ¼-scale C-130, watch pylon racing, are given a very detailed introduction to electric flight, are shown a chopper or two, fly some pattern aerobatics, look in detail (and detail there is!) at top-of-the-line scale models and watch sailplanes launch and land. There's a definite bias toward big; the announcer tells us that "larger sizes are poetry in repose as well as poetry in motion." This sort of soppy language clogs the narration: the sky is always "robin's egg" or "powder" blue, and so forth.

If this tape was redone today, the apologies for electrics would no longer be necessary, the helicopters would do a lot more aerobatics and the radios wouldn't be made by Kraft. Nonetheless, it's a good "backgrounder" that a club might well find occasion to use. This tape, however, leaves the distinct impression that models never crash. Or at least, never on camera.

THOSE MARVELOUS MINIATURES

Subject: *flying many different kinds of model airplanes.*
Source: *Academy of Model Aeronautics, 5151 E. Memorial Dr., Muncie, IN 47302.*
Summary: *wide-ranging, often funny and informative, but dated.*
List price: *$19.95.*
Approximate length:
46 minutes.

While rather dated in style and content, this is a good overview of our hobby. An opening sequence that shows a model plane ending its flight on a roof evoked memories of my very first airplane, which came in a cereal box and perished in exactly the same way. Interesting older models are shown in preserved black and white footage. This is from an earlier era, when the leading edge of technology and the epitome of individual heroism were combined in Lindbergh's transatlantic flight, and modeling became all the rage. For the most part, flight is now routine—even boring—but it hasn't lost its magic for sport fliers and modelers.

Because this film was made at a time when the narration tells us that model helicopters were new and that Yugoslavia and the USSR were places one went to compete, control-line activities are better represented than in more recent overviews of our hobby. The importance of model aviation to science and commerce is amply illustrated, and NASA engineers are seen testing the space shuttle concept and Rogallo wings in miniature. This and the work of Maynard Hill on all-electronic attitude sensing give credence to the claims that modeling is both educational and valuable to society. The size of the production line at a now-defunct American radio-control-systems manufacturer gives some feel for the economic importance of the hobby. This was once a good film to show to governmental agencies deciding on whether to allow model airplane flying at local fields. An update emphasizing today's silent, electric models would be welcome for this purpose.

The crashes are treated well, and the sound effects that are supplied for many of them are hilarious. The shot of two kids pointing "it went that-a-way" to a control-line pilot whose lines were cut in combat

(Continued on page 63)

SPORT FLYERS MEMBERSHIP APPLICATION

The author, John Gorham, at the sticks.

R/C VTOL Makes History

by JOHN A. GORHAM

From hover to horizontal flight and back

DURING THE SUMMER of 1992, Grumman Electronics Systems decided to build a ⅓-scale R/C model of a proposed VTOL (vertical takeoff and landing) UAV (unmanned aerial vehicle) aircraft. They wanted to use their patented vane-control system, which employs two vanes that are set at a 90-degree angle. The vanes cover the full exit diameter of the jet or turbo fan engine (see photos next page). They're moved by the flight-control servos, and they can control the pitch, roll and yaw of the aircraft.

Grumman chose AeroVironment Inc. of Simi Valley, CA, to build the model. As a consultant to AeroVironment, my role was to help design the flight-control system and to fly the model. Earlier Grumman programs had already shown that it was possible to hover an R/C model, and Tom Hunt of Grumman had spent many hours flying them (see sidebar). However, to my knowledge, no remote- or pilot-controlled model that used the vane-control principle had achieved the transition from hover to forward flight and back to hover. This element of "it ain't been done before" naturally interested me, and I was very proud to be part of this program.

EQUIPMENT SELECTION

Since we were "breaking new ground," we decided to develop the model in stages, obtaining the results from each stage before we proceeded to the next. To establish the value of vertical thrust that we could achieve, we needed to select a suitable powerplant for the model. A typical, modern ducted-fan engine and fan combination with off-the-shelf components can produce 10 to 12 pounds of static thrust, so two of these units would produce more than 20 pounds of thrust. The model would have to weigh less than 20 pounds to operate as a VTOL.

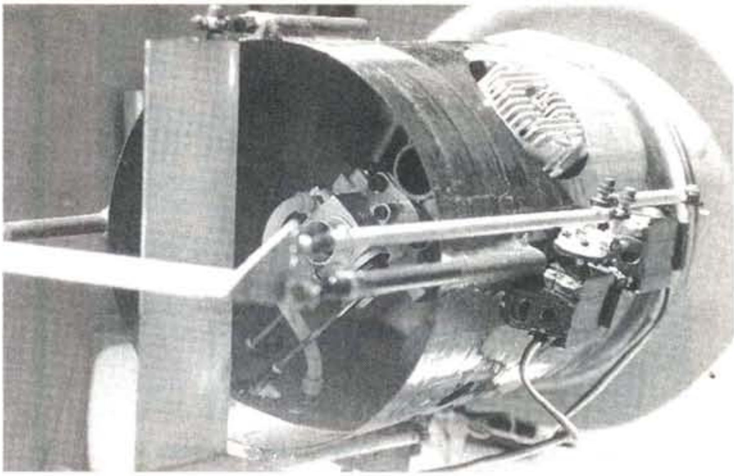
AeroVironment Inc. has considerable experience building the lightest possible airborne structures, and after some calculations, they decided that a model with an 8-foot wingspan and a total weight of less than 20 pounds could be flown to the designated flight profile. It would then have an acceptable 4 pounds per square foot of wing loading for its forward flight mode.

During this first phase, the elements of the flight-control system were thoroughly studied. I decided that the risks associated with test-flying a completely new concept were high enough without introducing more risks by using unknown or recently developed electronic equipment. We decided to use a JR* X-347 radio, an existing, "off-the-shelf" radio-control system that I believed had all the capability needed for the complex control system of the model. The JR X-347 radio system had an adequate range of the necessary mode features and was flexible and easy to program.

The R/C VTOL in a slow, forward-moving hover.

PHOTOS BY NASA & JOHN A. GORHAM

The nacelle is shown "en route" from horizontal to vertical flight modes.



This close-up of the control-vane assembly shows the rear view of the starboard nacelle in a horizontal flight position. The pitch/yaw and roll-control vanes are visible.

The servos had to be light and very strong, so we chose the new Futaba* S3002 servos. Chart 1 shows how they were used.

Two gyros (Futaba FB-G3BB) were used in pitch and roll; this was necessary to provide sufficient damping while in the hover mode.

The weight allocation of the 18-pound finished model is shown in Chart 2..

CHART 1

Function	Quantity
Pitch-control vanes	2
Roll-control vanes	2
Yaw-control vanes	2 (mixed with pitch)
Ailerons	2
Elevator	1
Throttle	2
Engine retract switching servo	1

CHART 2

Item	Total Weight
Engine and fan (2)	80 oz.
Nacelle and controls (2)	16 oz.
Center fuselage	38 oz.
Wing	40 oz.
Tail unit (complete)	20 oz.
Radio installation	40 oz.
Retract mechanics	10 oz.
Landing gear	20 oz.
Fuel	24 oz.

Twelve ounces of fuel were allowed for each engine, and that gave a maximum engine run time of 4 minutes.

ENGINE AND FAN

The design process continued over the next few months. We constructed a hovering platform that used the hardware and control system so we could get a feel for handling the machine in the hover mode. Then we procured the engines and the fans, built the ducts out of composite materials and took static thrust measurements. After we had evaluated different engine and fan combinations, we decided to use a Hurricane* 6-inch-diameter, 8-blade fan with the O.S.* 91 engine and *no muffler*. The main reason for the absence of a muffler was to flatten the response of the thrust curve at the top, since most hovering would be done at 90 to 100 percent thrust. We found we could obtain 11 to 12 pounds of thrust from each engine. As the pilot in the program, my background in helicopter flying helped speed the learning process.

LEARNING TO HOVER

Phase two involved learning to hover the platform. To make it more realistic for the pilot and representative of the inertia of the final model, the platform was fitted with a dummy foam wing and tail assembly. We conducted this phase indoors, with a light tether attached to the ceiling to minimize any possible catastrophe (to the machine and/or the surroundings), but we still hit the light fixtures on one occasion.

These initial hovering trials were conducted in a 20x20-foot room (the model had an 8-foot span), and my task was learning how to hover the beast. Many short flights later, my skill level hadn't improved much. Hovering proved to be more difficult than I thought; the reasons for this weren't fully understood until we fitted strips of Mylar tape on the model and the walls of the room. They showed the directions of the airflow—every which way—so it wasn't difficult to understand why hovering had proved to be so difficult. We were attempting to hover in an environment of strong and random gusts from all directions—including up!

We needed to move into a larger room to minimize the air eddies. Because I'm a NASA consultant, I was able to ask NASA-Dryden if they could find a larger space for us if we promised to keep the device tethered. NASA cooperated quickly, so we test hovered the model again in the comparatively vast space of the NASA hangar. Control was instantly much easier. I soon became confident that we could successfully achieve all the phases. After several days of stationary hovering and slow forward hovering, the model was prepared for phase three—outdoor "free" flight.

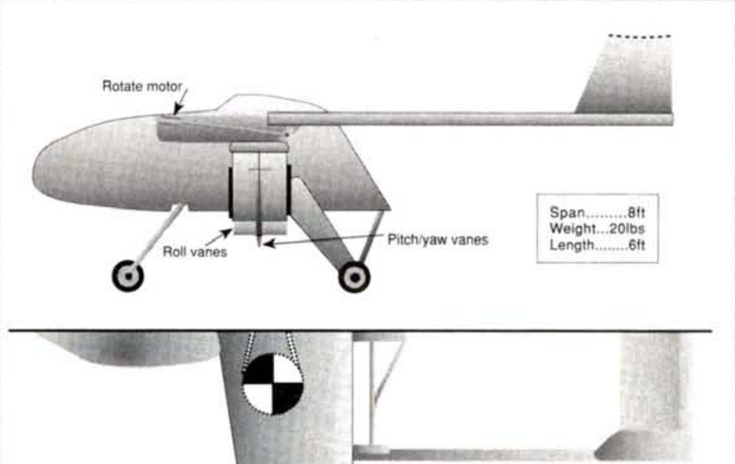


Figure 1

To ensure a low weight, the ⅓-scale R/C VTOL model was constructed from carbon-fiber composites, foam, Kevlar and wood. The wing has 5 degrees of washout at each tip, and the plane uses a NACA 4415 wing section.

Author John Gorham next to the history-making, 1/3-scale VTOL UAV.

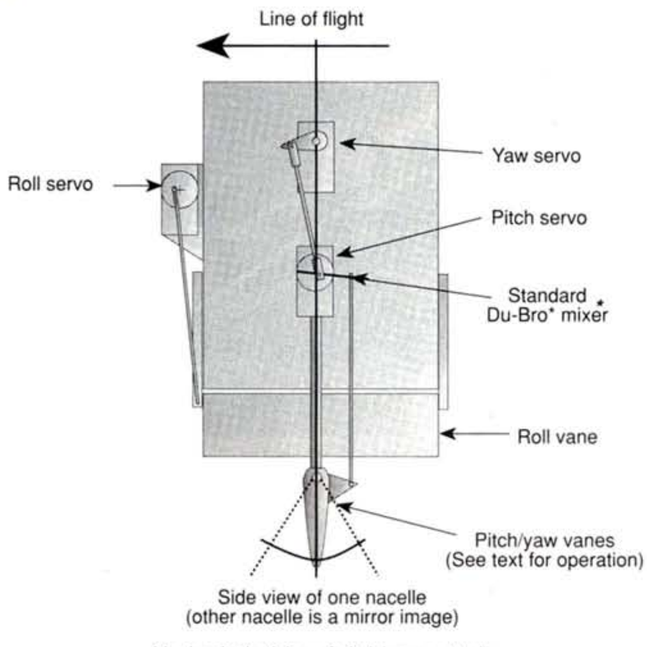


Figure 3

The pitch/yaw vanes (mounted athwart ships) are connected to a yaw servo that's mechanically fed to the vanes through a Du-Bro mechanical mixer; this is mounted on the pitch servo output shaft. The pitch servo directly drives the vanes. Thus, by arranging the rotations correctly, the transmitter pitch lever can direct both pitch/yaw vanes fore or aft for nose-down or nose-up pitch control. The yaw (or rudder) lever on the transmitter controls the same vanes via the mechanical mixer to make one vane move forward and the other aft; this provides yaw control.

ENGINE ROTATION

Up to this point, the engines had been fixed facing down. The team designed a mechanism that would rotate the engines (on command from the pilot) 90 degrees aft so they would be in the line of flight for the transition and forward flight. A lead screw that rotated both engines simultaneously (see Figure 2) was driven by an Astro Flight* 035 motor turning a 3.5:1 Master Airscrew* gearbox. The retract command was achieved by the use of a small servo (Futaba S133) that was activated by the radio retract switch on the transmitter. This servo opened and closed dual microswitches at either end of its travel.

One interesting and significant control anomaly occurs when the nacelles are directed into the line of flight. The roll vanes provide a small yaw force (fortunately, into the turn). The pitch vanes still provide movement correctly, but the yaw vanes now give an adverse rolling moment. All of these forces are relatively innocuous in forward flight, and we decided to live with the pitch and yaw forces. We reduced the yaw channel gain to zero, however, when the model was in forward flight. The aircraft didn't have any moving rudders; all the turns were performed by aileron only. (Obviously, it was important to reestablish yaw control by switching up the gain immediately after starting the inbound transition. On one occasion we didn't, and the VTOL crashed owing to a lack of yaw control. Sorry, guys.)

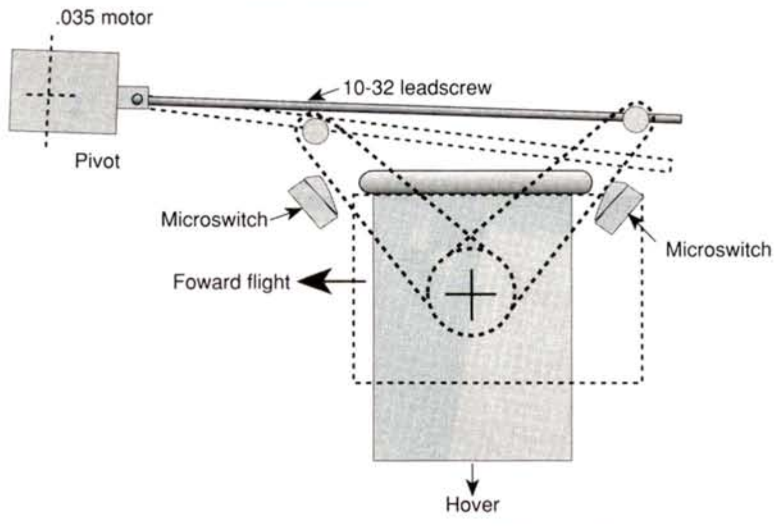


Figure 2

TRANSITION TO FORWARD FLIGHT

At this point, there were many discussions with Grumman and AeroVironment personnel on how we would approach the transition from hover to forward flight and vice versa. If the first attempted transition from hover to forward flight was successful, the model would land like a fixed-wing plane to relieve the stress level of yours truly. The aircraft would then take off conventionally, and after positioning it at a safe altitude, we would attempt the inboard transition from forward flight to hover for the landing.

For the final flight tests, we needed a relatively private airfield that would tolerate a high noise level. Fortunately, I'm a member of the Channel Islands Condors Club in Camarillo, CA. The board of directors

The author hovers the VTOL at a NASA hangar. Note the dummy wings that were used in hover-testing and the NASA lifting body at the rear (NASA photo).

instantly understood the importance of our need and cooperated to the maximum. We chose quiet days when nothing else was happening.

On the very first day of the tests, I did several outdoor untethered hovers to confirm that the engines were giving equal thrust and that they weren't likely to fail during the important 3 minutes of flight. I put the model up into the hover and tried to remember all our discussions on how the outbound transition should be done. I had forgotten almost all of them. The only thing I remembered was to put on plenty of power to make it go up ("make the houses become smaller"), and I pushed the stick forward to make the aircraft go forward as a result of the forces exerted by the dual-pitch vanes. When the model was at what I thought was a reasonable altitude and forward speed, I remembered sadly that the studies had shown it would lose some altitude during the initial rotation of the engines. I flipped the switch to rotate the engines, and as they rotated on their 7-second journey to the horizontal, the increasing forward thrust vector increased the air speed needed for forward flight. The model now became an airplane! There were loud cheers from the spectators (many club members), and my knees felt weak. Tom Hunt successfully landed the aircraft in the traditional fixed-wing manner, and the second transition was attempted with improved results.

TRANSITION TO HOVER

Later that week, we flew the transitions from forward flight to the hover. The model took off like a fixed-wing craft, and it flew into position, preparing for the transition to hover. I remembered our technical discussion: "It might be tricky, and the model could flip onto its back, or go into a deep stall." Notwithstanding, I got the model pointed toward me in a position that would, with a helicopter and the current wind conditions, give a good autorotation profile.

With reduced throttle, the craft slowed down even more, and I flipped the switch to rotate the engines to give upward thrust. The model slowed down, and as predicted, it reared its nose up. I immediately countered that with forward stick. I then flipped the other switch to re-introduce the yaw channel, and it came down in a very stable hovering mode. First surprise: it worked, and it was very much the same as an autorotation. Second surprise: I had no idea how high I was

(Continued on page 63)

R/C VTOL HISTORY

This staff report was based on an account by Tom Hunt and Bob Kress

The Nutcracker, an early Grumman R/C VTOL design, is shown in flight. Tom Hunt piloted this early "proof of concept" model.

The R/C VTOL that John Gorham flew is the culmination of a series of designs developed by Grumman Aerospace and Electronics since 1975. All of them used "vectored thrust," which was based on servo-actuated and gyro-stabilized control vanes (patented Grumman technology). Three personalities who played key roles in the historical development of the R/C VTOL concept are well-known in the hobby today: Bob Kress of Kress Jets (and a former Grumman VP) conceived the initial VTOL designs; Nick Ziroli, a famed plan designer and model builder, built the earliest VTOL models on contract with Grumman; and Tom Hunt, a Grumman aerospace engineer, who has written frequently for the modeling press, piloted the craft in hover mode and also assisted in identifying and working out bugs in various concept models.

Four models helped pave the way for the first successful "transitionable" (from hover to forward flight and vice versa) model. With the exception of the Stalker noted below, they were all scale models of intended full-size (man-carrying) vehicles. The 1975 model 674 Nutcracker (see photo) was the earliest and, perhaps, the most unorthodox design. The fuselage was hinged so that the powerplants could rotate to vertical while the cockpit remained horizontal. This "hover only" model was powered by two O.S. .60 rear-rotor engines that drove conventional props inside an enclosed cowl. Control of the model during hover was accomplished with forward flight elevators and rudders that controlled pitch, yaw and roll. (This was an early application of the vane concept.)

The model 698 was a refinement that was less risky, because it didn't have a hinged fuselage. Rotating nacelles with vanes provided control of the model in three axes during hover. Dozens of flights were made without any major problems. (Grumman, with the help of NASA and the Navy, later built and tested a 3/4-scale wind-tunnel model that had live TF34 turbo fan engines!) Both of these models were tethered, because of the 28V power requirement of the instrument gyros, and they both used conventional propellers.

In the mid-to late '80s, the model 754 Stalker was developed. It was the first successful, untethered VTOL model, and it used a conventional Byron fan. It had a novel design—separate lift and cruise ducted-fan engines. It also used vane technology, but state-of-the-art Futaba gyros took the place of the instrumentation gyros, so the tether could be removed. Ducted-fan propulsion and gyros in the hobby had come a long way.

Tom Hunt experimented with movable "elevators," which were mounted directly on the ducted-fan stators, in an attempt to improve yaw response. He also found that he could accelerate the model up to 20mph by tipping it forward and applying reserve power to maintain altitude (stopping was another matter!). When the wing passed from about -5 degrees to about +5 to +10 degrees, the model quickly climbed a few feet as the wings began to lift.

Then the 755 Zephyr model was developed; it was a fan-in-wing concept model that used three fans (one in each wing and one for cruise). A large prop fan provided lift, and the third engine that spun a ducted fan controlled pitch. In the wings, two O.S. .46 VRDFs spun Rev-Up* 10x5 props at nearly 18,000rpm for a total of more than 11 pounds of thrust per fan, unpiped! Some variants of the Zephyr held surprises; experiments with tuned pipes showed that when an otherwise sluggish model was having difficulty in hover, coming "on the pipes" would catapult the model toward the hangar ceiling. An air re-circulation "bug" at one point caused the model to squash its tires rather than lift off; the net thrust pulled the plane down instead of up!

By solving these problems, Grumman learned numerous lessons. They were used ultimately by AeroVironment and John Gorham as they configured the R/C VTOL—a model that combined the successful technology from all those before it.

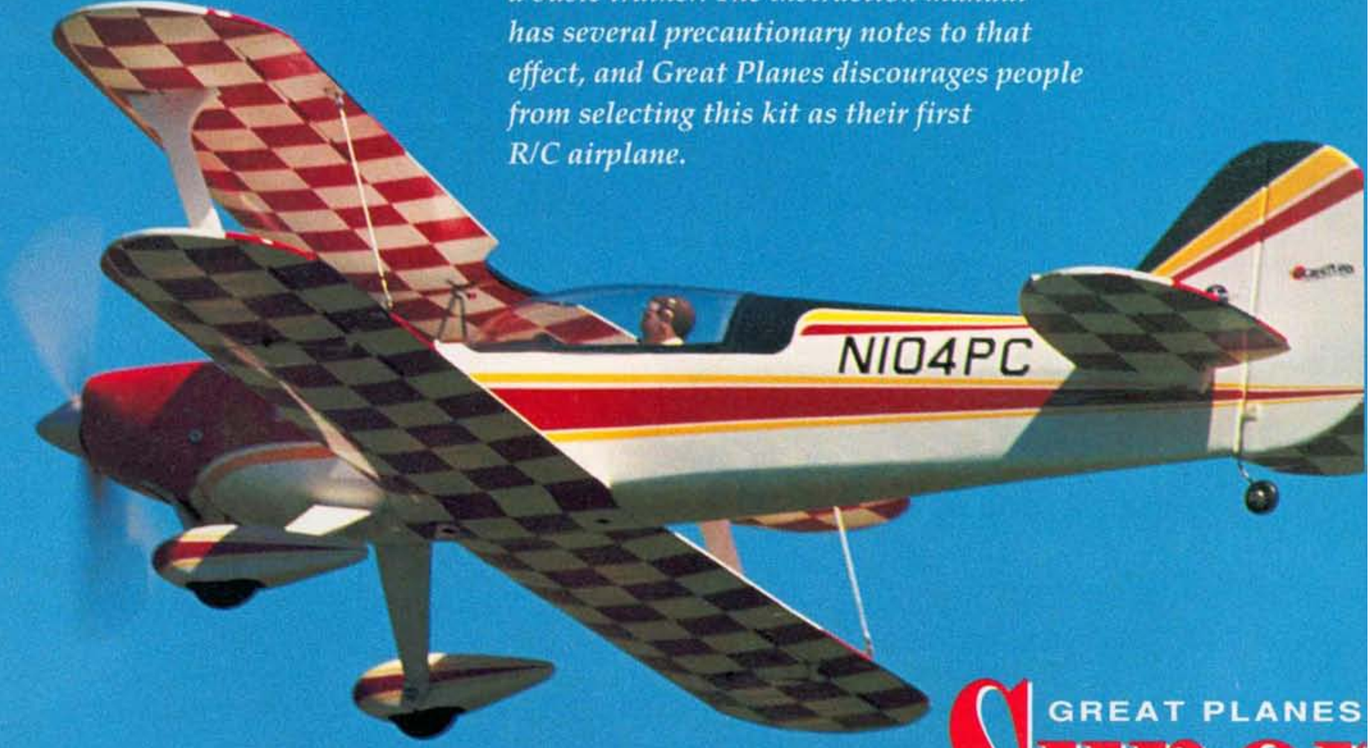
MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

Here I am assembling the Super Skybolt for another day at the flying field. Though it's a biplane, the model's unique design allows for a quick, 2-minute assembly.

by JIM ONORATO

I'VE ALWAYS BEEN partial to biplanes, so when I was asked to review Great Planes' Super Skybolt, I jumped at the chance. I recently saw a full-size Skybolt at the airport in Stormville, NY, and I knew that someday I would have to build a model of that plane. Little did I know that it would happen so quickly!*

The Super Skybolt is a high-performance biplane that's modeled after the full-size Skybolt. This is not a beginners' airplane! It's highly maneuverable, and it doesn't have the self-recovery characteristics of a basic trainer. The instruction manual has several precautionary notes to that effect, and Great Planes discourages people from selecting this kit as their first R/C airplane.



EASY SETUP AND GREAT PERFORMANCE

GREAT PLANES

Super Skybolt

FLIGHT PERFORMANCE

• Takeoff and landing

The first flights were from a freshly cut grass field on a very windy day. I used low rate on rudder and aileron and high rate on elevator. I pointed the Skybolt into the wind, applied a little up-elevator and slowly advanced the throttle. The Skybolt tracked straight as an arrow without any application of right rudder. When flying speed was attained, the Skybolt lifted smoothly into the air. At this point, the throttle was at about one third. As power was applied, the Skybolt began a 45-degree ascent with the wings perfectly level. Even in high wind, the plane was steady as rock. The landing was just as easy. Because of the brisk wind, I maintained a little throttle on final approach until the plane was about 2 feet off the ground. When I cut to idle, the plane slowed nicely and remained stable until touchdown.

• Slow-speed performance

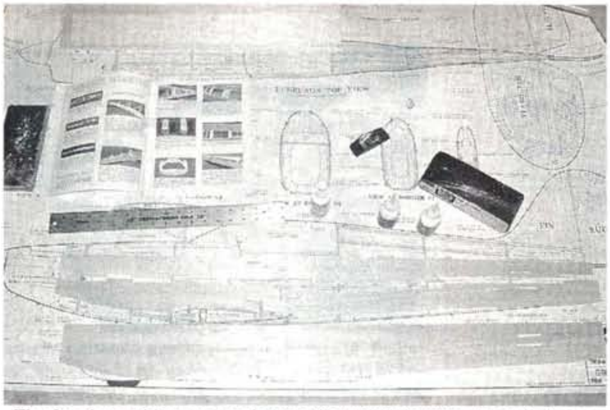
The Skybolt is smooth and predictable at low speed. It has an extremely low stall speed, and stalls are gentle and straight ahead. Control response is good at all speeds. Low and slow passes are a breeze. You never get the feeling that you have to fight the controls to keep the plane stable.

• High-speed performance

The Skybolt is a go-where-you-point-it airplane at high speed. It tracks extremely well, and it's a very smooth, stable flier. The only problem I encountered was a tendency of the plane to roll out of outside maneuvers with the elevator at high rate—a tendency that was all but eliminated at low rate. The Surpass 120 is a powerful engine and pulls the Skybolt straight up. With a little practice, I'm sure I'll get it to torque roll.

• Aerobatics

The Skybolt is highly maneuverable and will perform almost every stunt imaginable. The recommended control throws are large and make for some pretty violent aerobatics. Axial and snap rolls are incredibly fast, and the spin is a thing of beauty. Sustained knife-edge and outside 360-degree turns are no problem for the Skybolt.

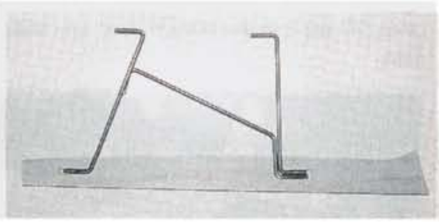


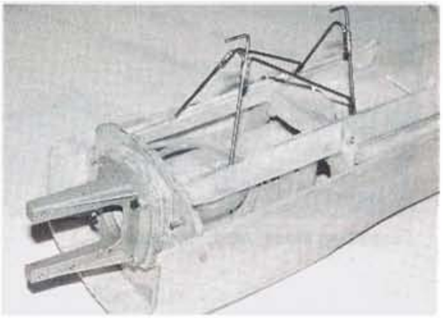
The fuselage sides are made up of four interlocking die-cut pieces. The plans are very clear and easy to read.

THE KIT

The kit comes in a beautifully decorated box that just begs to be opened. The goodies inside include an engine mount, a landing gear, pre-bent cabane wires, a hardware package, a cowl, a canopy, wheel pants and decals. Unlike some kits on the market that include flimsy ABS parts, this kit includes an ABS cowl and wheel pants that are quite acceptable.

A unique wing-attachment system makes it very easy to disassemble the plane at the field. The bottom wing is attached to the fuse using two bolts. Brass tubes embedded in the top wing permit it to be slid onto the cabane struts and locked into place with a thin wire. The interplane struts have four, preformed 1/16-inch wire "hooks" that slide into slots in both wings and are locked into place with 1/32-inch locking wires. The whole assembly process takes about 4 minutes!





• Top: here are the left cabane wires placed in their plywood holder. The wire in the kit comes bent, which greatly simplifies the building process. • Bottom: the finished cabane wires installed in fuselage. I partially built the top wing and used it as an alignment tool before soldering the cabane wires together.

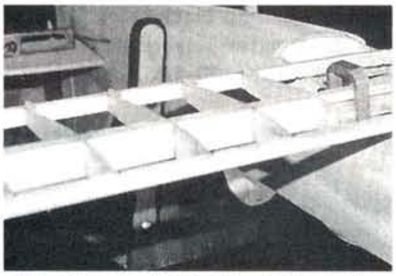
CONSTRUCTION

I used Satellite City's* Hot Stuff, Super T and Kick It accelerator for most of the construction. I also used epoxy on the firewall, cabane holders, landing-gear mounting plate, stab sheeting and the wing-bolt plates.

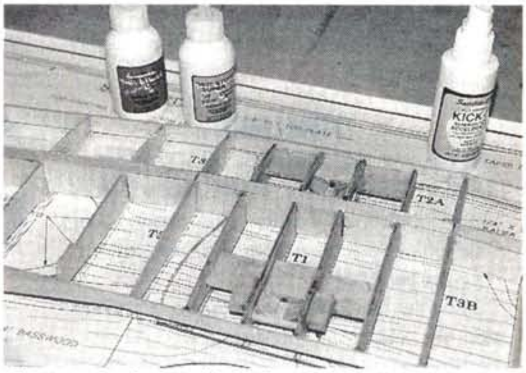
TAIL FEATHERS

The fin, rudder, stabilizer and elevators are built over the plans using 3/16-inch-thick, die-cut balsa parts and 3/16x1/4-inch stripwood. The framework went together perfectly, and it was obvious that the die-cutting in this kit is excellent. I sanded

The interplane struts are also held in place by wires. Here you see the construction of one of the struts before the sheeting is applied.



The setup for joining the bottom wing halves is unusual. The top wing and interplane struts are assembled, and then the model is placed upside-down on the work bench. The bottom wing halves are installed in the wing saddle and glued together. Here, I have C-clamps holding the main spar as the epoxy cures.



The top wing has no dihedral, and it's built flat on top of the plans. In the center section are the plywood receptacles for the cabane wires. The cabanes simply slip into the two horizontal holes.

SPECIFICATIONS

Model name: Super Skybolt (kit no. SKY6)
Manufacturer: Great Planes Model Mfg. Co.
Type: Aerobatic sport scale biplane
List price: $224.95
Wingspan: 57 in.
Wing area: 930 sq. in.
Airfoil: symmetrical
Weight: 9 lbs., 12 oz.
Wing loading: 24.2 oz./sq.ft.
Length: 52 in.
Radio: 4-channel with dual rates
Engine range: .60-.91, 2-cycle; .90-1.20, 4-cycle
Engine used: O.S. FS-120 II Surpass
Muffler: Slimline model no. 4001

Features: the fuselage is sheet balsa over plywood formers. The tail surfaces are built-up and fully sheeted. A unique wing-attachment system uses only two screws, which makes field assembly easy. The wing ribs have jig tabs so that the wings can be built on a flat surface directly over the plans. The kit includes an adjustable (.40 to .70) engine mount, Dural landing gear, pre-cut balsa shear webs, ABS cowl and wheel pants, vacuum-formed canopy, decals and a complete hardware package. Hinges aren't provided because the builder is expected to choose his own. Two rolled sheets of full-size plans and a 72-page instruction manual are provided. The plane can be built with either one or two aileron servos and two or four ailerons. The plans and instructions show both methods of construction.

Hits
- High-quality materials and die-cutting
- Fully detailed, step-by-step instruction manual
- Complete hardware package
- Unique wing attachment system makes field assembly quick and easy
- Excellent flight performance

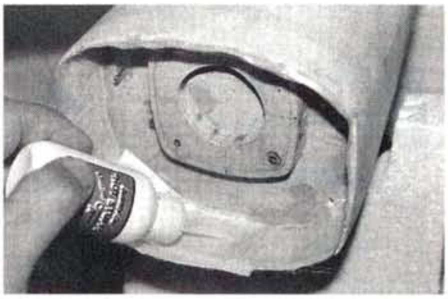
Misses
- Sequence of construction for fuselage (see text)

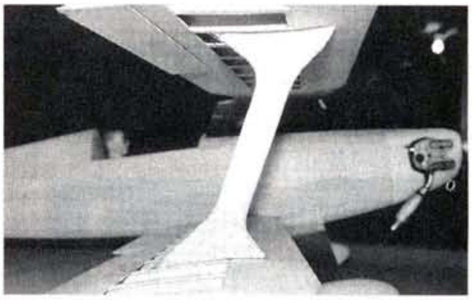
the trailing edges of the rudder and elevators to a thickness of 3/32 inch and sheeted the frameworks with 1/16-inch-thick balsa, top and bottom. This resulted in a strong, lightweight structure.

FUSELAGE

The fuselage sides are made up of four, interlocking, 1/8-inch-thick, die-cut, balsa pieces with 1/8-inch-thick doublers, also made up of four die-cut pieces. Again, all of the parts fit together perfectly.

Since the fuselage has a rounded cross section, the 1/8-inch lite-ply formers are, at first, tack-glued to the upper edge of the fuse sides. The bottom edges of the sides are pulled into place and glued later. To give it extra strength, I put a 1/2-inch-wide piece of 1/8-inch-thick ply across the upper portion of former F2 (step 5). (There's a considerable amount of stress put on F2 when the forward section of the fuse is pulled together later on.) This 1/2-inch piece was attached to the front of F2 so that it wouldn't interfere with the cockpit bottom. It also provides extra gluing area for the cabane holders that are added later.



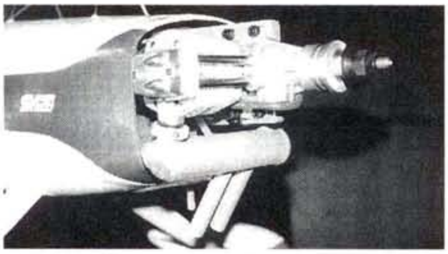


• Left: to reinforce the fuselage sheeting forward of the firewall, I glued glass cloth to the inside surface using Hot Stuff. • Rigth: close-up of installed interplane strut. Notice the two smaller wires that hold the struts securely locked in position. Disassembly is very quick.

Framed-up model ready for covering.

The two, 1/4-inch-ply, wing-bolt blocks fit into notches in the fuse doublers and have 1/32-inch-ply braces for added strength. I found it impossible to slide the rear-wing bolt block into place as called for in step 6, because former BP had already been glued in place in step 3. I had to cut out BP to allow the bottom edge of the fuse to spread out enough for the bolt block to be installed. Former BP should be installed after step 6!

The 1/8-inch-balsa, aft-fuse bottom is supposed to keep the aft portion of the fuselage straight. Make sure that the rear of the fuse sides are perfectly vertical before you glue the bottom in place; otherwise, it won't be aligned properly.



I used a Slimline muffler for my 4-stroke 120. It has a unique mounting design that keeps the expansion chamber very close to the engine for a tight, compact installation.

The firewall, the landing-gear former and the fuel-tank floor are all installed at the same time. It's difficult to snap the fuel-tank floor into place at this time because former F2 is already installed. It's much easier to install the tank floor (but not glue it) when you install former F2. Make sure the tank floor is right side up because the front is cut at an angle that establishes the proper amount of right thrust when the firewall is installed. In order to provide room for a 4-cycle engine, the firewall is set back more than an inch behind the front edge of the fuselage sides. The overhanging balsa is reinforced with fiberglass tape, which I applied with thin Hot Stuff.

Assembling the cabanes is a critical step; they have to be installed so that the horizontal parts of the cabane wires are directly over the fuselage's center, aligned front to rear and set at an angle to give the top wing 1 degree of negative incidence. I skipped ahead at this point, built the top wing (through step 23), and used it to help get everything aligned before soldering the cabane wires. I strongly recommend this building sequence.

WINGS

Other than the parts associated with the attachment system, the wing construction is pretty conventional. I built the halves of the bottom wing first but I didn't join or sheet them.

The ribs that hold the interplane struts are made of a die-cut, 1/16-inch-ply rib that's sandwiched between die-cut, 1/8-inch balsa ribs. I made sure that the interplane strut cutouts were on top.

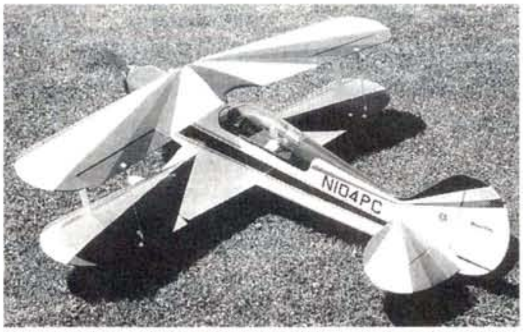
The Super Skybolt is a fine-looking, high-performance biplane that flies beautifully.

The top wing was built in a similar manner but with the interplane strut cutouts on the bottom. Because there's no dihedral in the top wing, I joined the two halves directly over the plans. Next, I assembled and installed the top plates that secure the top wing to the cabane wires. The instructions and photos in the manual guided me through this critical step with no problems.

I sheeted the top wing, added the formed trailing edge and ailerons, and sanded the entire wing. (I decided to install ailerons on both wings.)

INTERPLANE STRUTS

The interplane struts, or "I-struts" as they are referred to in the plans, are the heart of the wing-attachment system. They are made up of die-cut, 1/8-inch ply struts sandwiched between 1/16-inch, hard-balsa sheets. Each strut has four, 1/16-inch, wire "hooks" that slide into the cutouts in the wings and two, 1/32-inch, locking wires that lock the I-struts in place. First, I glued the balsa sheet to the left side (as viewed from the cockpit) of the I-strut so that I could position the strut over the detail drawing on the plans when I installed the 1/16-inch wires. After all the wires were firmly glued into place, I sheeted the right side of the struts and rounded off the edges to achieve a smooth, aerodynamic cross section on the entire strut. I then reinforced the ends with light glass cloth, which I applied with thin Hot Stuff.



The model was finished with Coverite's 21st Century fabric.

COMPLETION OF BOTTOM WING

The halves of the bottom wing were joined in an unconventional manner. The fuselage was placed upside-down in a model stand with the top wing and I-struts installed. The halves of the bottom wing were then attached to the I-struts with the root ends resting on the fuselage wing saddle. When I was satisfied with the fit, I glued the halves together with Super T, installed the dihedral braces and removed the wing. I then added sheeting, the formed trailing edge, ailerons and two aileron servos. I re-attached both wings to the fuselage before drilling the holes for the two wing bolts.

FINAL ASSEMBLY AND COVERING

Final assembly consisted of building the bottom wing fairing and installing the landing gear, wheel pants, pilot, canopy and cowl. The cowl is molded in two pieces, front and back, which was helpful when I made the cutout for the engine and muffler.

I installed an O.S.* FS-120S II Surpass engine with one of the new Slimline* Pitts-style mufflers (model no. 4001). This muffler is designed specifically for the 120 Surpass, and it has a clever mounting system that lets the muffler nest snugly under a side-mounted engine.

I chose Coverite's* 21st Century fabric for the covering, and I was delighted with the choice. I sanded the entire plane with 400-grit sandpaper and applied one coat of Balsarite*. I used the same color scheme as the prototype, but I substituted Cub Yellow for gold on the upper surfaces because the fabric doesn't come in gold. The 21st Century fabric went down beautifully with virtually no bubbles. I painted the cowl and wheel pants with matching colors of 21st Century spray paint.

CONCLUSION

The Super Skybolt is a fine-looking, high-performance biplane that flies beautifully. Although construction is somewhat complicated, the plans and instruction book (with the exception of the construction sequence on the fuselage, as noted earlier) are very well done, and they guide the builder every step of the way. I highly recommend this kit for intermediate and advanced modelers.

**Here are the addresses of the companies that are mentioned in this article:*
Great Planes Model Mfg. Co., *P.O. Box 788, Urbana, IL 61801.*
Satellite City, *P.O. Box 836, Simi, CA 93062.*
O.S.; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign IL 61826.*
Slimline Mfg., *P.O. Box 3295, Scottsdale, AZ 85257.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*
Balsarite; *distributed by Coverite.*

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

Twinn-K Gyro-1

by GERRY YARRISH

A PERFECT FIRST STEP TOWARD FUN-FLY COMPETITION

IF YOU'VE EVER seen a fun-fly model go through its aerial ballet, your first impression may have been that they're too advanced for your next project. Blurring rolls, 4-foot-diameter loops and incredible snapping maneuvers are their high cards. The sure bet, though, is their capability to fly at super-slow airspeeds. The transition from "normal" models to these fanciful fliers just got easier with the introduction of Twinn-K's* Gyro-1.

Yes, the Gyro-1 is intended for the experienced pilot, but with its enhanced slow-flight capabilities, unique design layout and easy construction, it's a perfect first step toward all-out competition. Straight-and-level is not the mission of fun-fly models; they use their power in vertical performance and maneuvers. The first thing most newcomers experience is a tell-tale buzz when the model is flown too fast, but the Gyro-1 is equipped with solid controls, and it's far less susceptible to flutter. You can easily tone down the Gyro-1 for mild behavior and still maintain in reserve all the attributes of a totally wild ride that will satisfy even the most jaded fun-fly competitor. Either way, the Gyro-1 looks as if it's a winner.

PHOTOS BY GERRY YARRISH AND TOM ATWOOD

CONSTRUCTION

All the major parts in the kit are bagged and organized. The instructions are well-written, but there aren't any construction photos to guide the way. At first, I thought the kit was missing stick stock for building the tail components, but after reading the instructions, I found that I had to use a balsa stripper to cut them out of supplied, extra lightweight, ¼-inch-thick sheets. Twinn-K does this to save as much weight as possible. It's a little more work, but you end up with a very strong, light structure, and the model's enhanced performance compensates for the extra effort.

There's nothing unusual about the tail and the ailerons, which you build first. The ¼x½-inch stock parts are built over the plans. I used California Carbon* iron-on carbon-fiber strips to help stiffen the trailing edges and minimize the warping caused by tightening the cover. The ailerons have ¼-inch tri-stock glued to their leading edges; this createsthe required bevel at the hinge line while adding additional stiffness to the structure. When complete, all the control surfaces are very light, and when they're covered, they're surprisingly rigid.

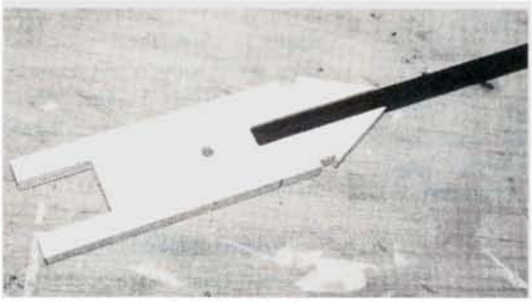
SPECIFICATIONS

Name: Twinn-K Gyro-1
Type: competition fun fly
Wingspan: 48 in.
Length: 45 in.
Weight: 3 lb.
Wing area: 816 sq. in.
Wing loading: 8.57 oz./sq. ft.
No. of channels req'd: 3 (throttle, aileron and elevator); rudder optional
Airfoil: symmetrical
Wing construction: built-up wood with hardwood spars
Fuselage construction: plywood engine pod and carbon-fiber tail boom
Washout built in: no
Engine used: Webra .32 2-stroke
Suggested engine range: .25 to .40 2-stroke
Prop used: 11x4
Sug. retail price: $89.95

Features: complete hardware, hinges, carbon-fiber landing-gear legs and lightweight wheel. The wing ribs are cut, drilled and ready for the supplied alignment jig dowels. Lightweight, ¼-inch-thick balsa sheets have been included so that the builder can cut his own stick stock for the tail parts and the ailerons. The wing is built with jig blocks over the plans, and the plywood engine pod is cut to shape. Full-size plans and instructions are also included, and the design is by Dave Pulfer and Ron Kahl.

Hits:
- Good slow-flight characteristics
- Lightweight, strong construction
- Fast building time

Misses:
- No instruction photos



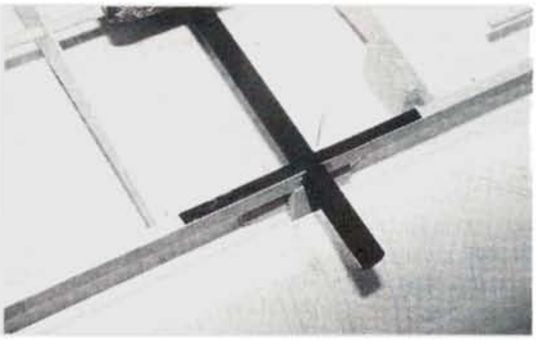
The first parts you build for the wing are the engine pod and main tail boom. Placing the plywood pod on top of 1/16-inch-thick shims centers the tail boom when it's glued into place.

The plans don't include a rudder, but it's easy to add two vertical balsa strips and split the stab in two. I made the rudder about three times larger than the vertical stab, and it works very well. Twinn-K decided not to include one on the Gyro-1 to save the weight of the pushrod, hardware and servo involved. Because it's so easy to include, it's up to you to decide if you want one.

I built the engine-mount pod and main tail boom next. When you place the plywood pod flat on top of two 1/16-inch-thick balsa jig pieces, the main tail boom is automatically centered in the pod. Once they're aligned, the boom and pod are glued together with medium CA.

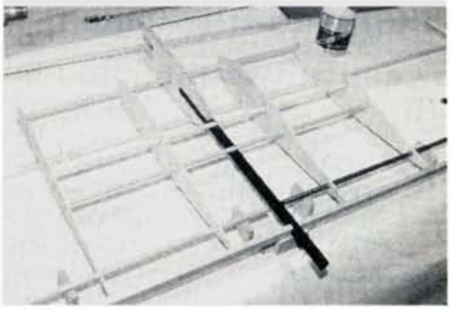
WING JIG

The arrangement of jig blocks on the building surface that ensure a straight and warp-free wing is unique to the Gyro-1. A diagram in the instructions shows how to place these blocks along with the alignment pins (ordinary straight pins) that set the position of the lower main spar. Holes in the ribs accept the supplied ¼-inch-diameter dowels; they rest on the blocks and automatically set the ribs in the proper position. I placed a ⅛-inch-square spruce strip under the main spar to set it at the proper height, and then I glued the finished engine pod over the spar.



For increased strength, I added ¼x.007-inch-thick carbon fiber to the trailing-edge/tail-boom intersection.

At this point, I installed the three main alignment dowels in the pre-drilled holes in the pod and the W-1 ribs. I then made and installed the 1⅛-inch-high jig blocks under the dowels and glued the first dowel into place. After marking the rib locations on these dowels, I slid the W-2 ribs into place and glued them in as well. Now I glued the ¼x½x24-inch-long trailing-edge stock into position. The inboard ends of the trailing-edge pieces have to be sanded where they meet the tail boom. I also drew a center line on the inside of the trailing edge to help me align the remaining wing ribs. After the trailing edges were glued into place and supported with 1-inch-high jig blocks, I glued the top wing spar and the remaining wing spars into place.



The wing is built over the plans using alignment dowels and jig blocks made of balsa. Holes that have been pre-drilled in the ribs accept the dowels; this method produces a warp-free wing.

After the ribs, it's time to glue the leading-edge spar and the upper leading-edge sheet spar that are both made of ⅛-inch square spruce. When the glue was dry, I added the 1/16x¾-inch trailing-edge sheeting. This is glued to the ribs and the trailing-edge stock. It butts up against the tail boom and leaves a ⅜-inch-wide gap between the left and right halves. The gap will be covered by a strip of carbon fiber later. After all the parts had been glued to the top of the wing, I removed it from the jig blocks and turned it over to install the lower spars.

The leading edge sheeting is a single-sheet of 1/16-inch-thick balsa for each half of the wing. It runs from the top L/E spar and around the leading edge to the lower L/E spar. I soaked the sheeting in water for about 20 minutes to soften it and to make it more pliable. I taped it into position and set it aside to dry. After it had dried, I glued it to the ribs, spars and the engine pod with thin CA. I then added the center-section sheeting, the cross-grain wingtip sheeting and the rib capstrips. A hatch in the top sheeting makes radio installation easy, and the plans show this in

FLIGHT PERFORMANCE

'st-flew the Gyro-1 on a slightly windy Sunday afternoon ng a JR X347 radio, a Webra .32 engine and a 4-ounce fuel k. After some initial engine tests, I decided to use an Master screw 11x4 prop. The model was set up with 40-percent ponential control on the ailerons and the elevator, and i/elevator mix was set at 40-percent up flap (spoiler) and 75 cent down flap.*

Takeoff and landing

: Gyro-1 took off with only about five clicks of throttle, and d off flat and accelerated quickly with near vertical perfornce at only half throttle. Slow motion best describes the ding. I turned the flap/elevator mix off during my first flight calm the model down considerably. With the mix function ned on, the model (even at very slow speeds) is extremely ponsive and solid. The second flight was a full-power blast , and the model climbed without hesitation and was at spinry altitude in about 8 seconds. With the throttle and the eleor pulled back, the model can hover for near-vertical and y precise spot landings. In a word—solid!

High-speed performance

jh speed isn't the mission of any fun-fly ship, yet the Gyro-1 owed no signs of impending flutter when I flew it at high eed. The "buzz" is usually heard if the throttle isn't pulled ck when the model exits a loop (the point at which straight d level is achieved). The Gyro-1's very solid control linkages sure that it enters into fast-forward flight very well; this can an advantage when you build momentum for a series of ineuvers. Snaps and rolls weren't a problem, and the model In't snap out of manuevers, even in 90-degree bank-andnk situations.

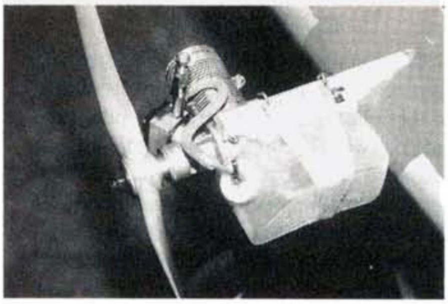
Low-speed performance

ow flight is a delight. With one-quarter throttle or less, the odel remains solid and responsive. Vertical performance is ninished, but when you ask the plane to loop or roll, it simply ikes a slow-motion response. In a slight headwind, the odel can hover, and aileron control keeps it level. When you ly around in near-zero air speed, the rudder provides positive w control as it deflects the prop blast. The transition from w- to high-speed flight with throttle application is quick, and : model accelerates without any trim changes.

Aerobatics

course, the Gyro-1 was designed for this. Rolls, loops, snapng maneuvers and spins are exciting. At full deflections, the ls are completely axial. With my setup (30 degrees up and wn aileron), the model will produce about 2¼ rolls per secd at about ¾ throttle. An elevator setup of 45 degrees up d down produced a loop with about a 5-foot diameter. My i is set at the forward location shown on the plans, and I was mpletely happy with the model's performance. Snap rolls are ry positive, but it took some practice to exit two snaps at a rel attitude. It's best to enter spins at near-zero air speed with l aileron, rudder and elevator. With my forward CG location, e model has a pronounced nose-down attitude, and the scent rate is high. With the CG in the aft location and the ntrols set at maximum deflections, the model is truly a comtitive performer. I haven't tried a true flat spin yet, but with e model's positive spin exit (just release the sticks), it should easy to accomplish. Inverted flight requires only a very ght forward pressure on the stick, and outside loops are easy d only slightly larger than inside ones. If you use a rudder, it ovides excellent yawing maneuvers, and a hammerhead turn very easy—even for a sport flier like me. The Gyro-1 will ake any pilot look as if he has hot thumbs!

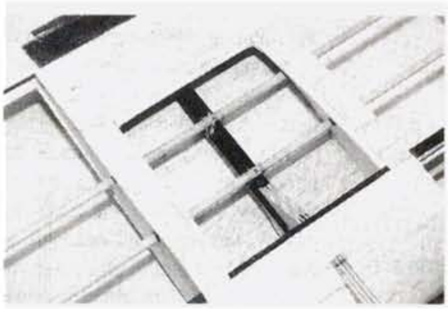
detail. A serious competitor only needs to sheet the top of the wing center section, but because I'm a sport flier, I added sheeting to the bottom as well. I can live with the slight increase in weight.



I installed brass hooks to the top and bottom of the engine pod so I could easily mount the fuel tank with rubber bands. Use foam between the tank and the pod.

RADIO INSTALLATION

The two center alignment dowels are also used as servo rails, and they add rigidity to the wing center section. The aileron servos are located near the dowel ends, while the throttle, elevator and rudder servo (if used) are placed in the center section. The 4-40 aileron pushrods and clevises are a straight run from the servo to the control horns, and the rudder and throttle pushrods exit the wing through the top sheeting that's just forward of the wing's trailing edge. The throttle pushrod also exits the wing through a hole in the sheeting. To keep the tail pushrods in as straight a line as possible, the plans show the servos' installation inverted, with the servo output wheel facing down. My JR* 4131 servos were too high, and they stuck out above the top hatch if I installed them in this fashion, so I decided to mount them upright. (A shorter servo can be installed as shown.)



I cut a hatch into the top wing sheeting to access the radio. Notice that the servo-mounting dowels have been glued and tied to the main tail boom with Kevlar string.

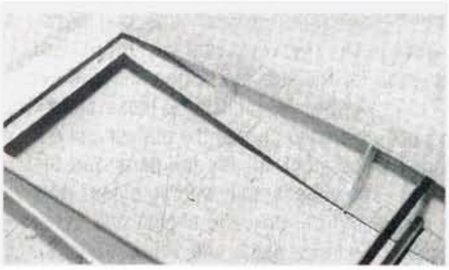
COVERING AND FINISHING

I used Hobby Lobby* Oracover film to cover the model, and I chose contrasting colors on the top and bottom of the wing to help with visual orientation. Because the bottom of an airplane is usually shadowed and the top is light and bright, I used white on top and dark blue on the bottom of this model. Bright orange wingtips and a red tail also help me see whether I'm coming or going.

FINAL ASSEMBLY

After I installed the radio, I mounted the engine, a 4-ounce fuel tank and the landing gear in the engine pod. Remember to seal the plywood pod with resin before you cover the wing. I also sealed the leading-edge sheeting just behind the engine to prevent the wood from becoming soaked with fuel residue. The wheel, the landing gear and all the hardware are supplied with the kit, and for those who would like to upgrade (and save some weight) on their own fun-fly models, Twinn-K sells the landing gear parts and wheels in a separate package.

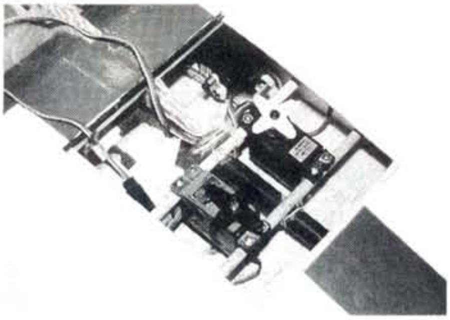
The tail parts are glued to the removable tail boom, and they're reinforced at the joints with balsa tri-stock. Once these have been positioned, I slid the rear tail boom into the main tail boom, and I set the distance from the aileron hinge line to the elevator hinge line at 22½ inches. I drilled and tapped the boom's mounting-bolt hole for a 4-40 cap screw that bolts the two booms together. If necessary, the boom length can be adjusted for proper CG location by drilling a new bolt hole. The plans show a small receiver battery pack tied to the tail boom with tie wraps, but I decided to



The ½-inch-wide capstrip for the tip ribs is supported by ¹⁄₁₆-inch-thick vertical grain balsa strips. This strengthens the rib and minimizes rib bowing when the covering is tightened.

mount the battery internally in the center section of the wing.

There are three carbon-fiber pushrod standoffs included in the kit. I slid them onto the tail boom and glued them into position after all the pushrods were installed and aligned properly. I made three more standoffs for the rudder pushrod and attached them the same way. This provided good support for both pushrods, and it's one of the reasons the model doesn't suffer from excessive flutter. In all, the control and response of the Gyro-1 is solid and smooth.



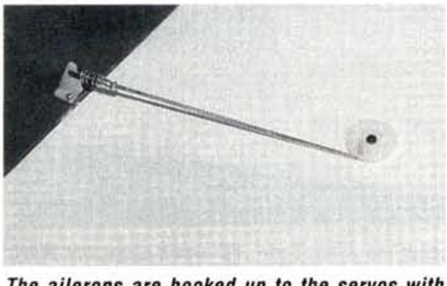
I mounted my rudder and throttle servos upright so the output wheels come through the top hatch cover. The plans show the servos mounted inverted.

RADIO SETUP

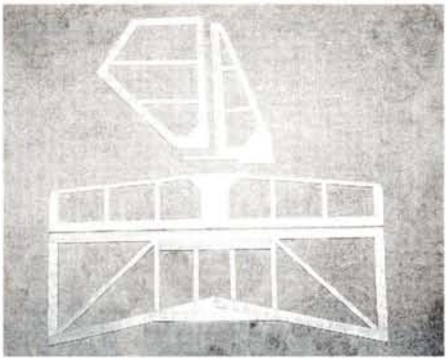
To get maximum performance from the model, you need a computer radio to mix in the various control functions. I used a JR X-347 radio with two 4721 servos on the ailerons and two 4131s for the rudder and elevator. The instructions suggest that you set up the elevator and the ailerons with 45 degrees of throw in each direction, and mix the flaperons and elevator together. I use 40-percent exponential on the elevator and ailerons for a softer feel around the neutral stick position. With this setup, the Gyro-1 is a joy to fly, and it's very responsive and forgiving. At full deflections, the roll rate is crisp, and loops are tight. Rudder control is good.

FIRST FLIGHT

The *first* time the Gyro-1 broke ground was in my backyard on a dead-calm Sunday after-

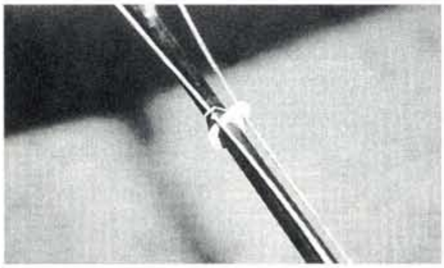


The ailerons are hooked up to the servos with 4-40 pushrods and clevises. These are included in the kit and minimize the possibility of control-surface flutter.



The tail pieces are made of balsa stick stock that was cut from the supplied ¼-inch-thick balsa sheet. They are easy to build over the plans. The rudder is optional.

noon. One of my secrets for successful first flights at the flying field with club members looking on is to test-fly new models before the *announced* first flight. Yep! It flew right off the workbench perfectly trimmed! Don't tell anyone!



Three carbon-fiber pushrods standoffs, which are included in the kit, support the elevator pushrod. Because I installed a rudder, I made three more standoffs out of ¹⁄₁₆-inch-thick plywood.

I use a Webra* .32 engine with a Dynamix carb, a standard muffler and an Master Airscrew 11x4 prop. The model has great vertical performance, and it breaks ground in about 4 feet. The flight was very exciting and drew a small gathering of neighbors who are accustomed to occasional aerial antics from the Yarrish airfield. Except for some excessive fuel foaming that I resolved by adding foam padding and additional rubber bands, it was a very rewarding flight. Now it was time to head to the flying field.

If you've ever wanted to try a fun-fly ship, but you've been scared away by their gyrations, the Gyro-1 is a good first step. It's a lightweight, quick-to-build model, and its slow-flight capabilities are very easy on the novice pilot.

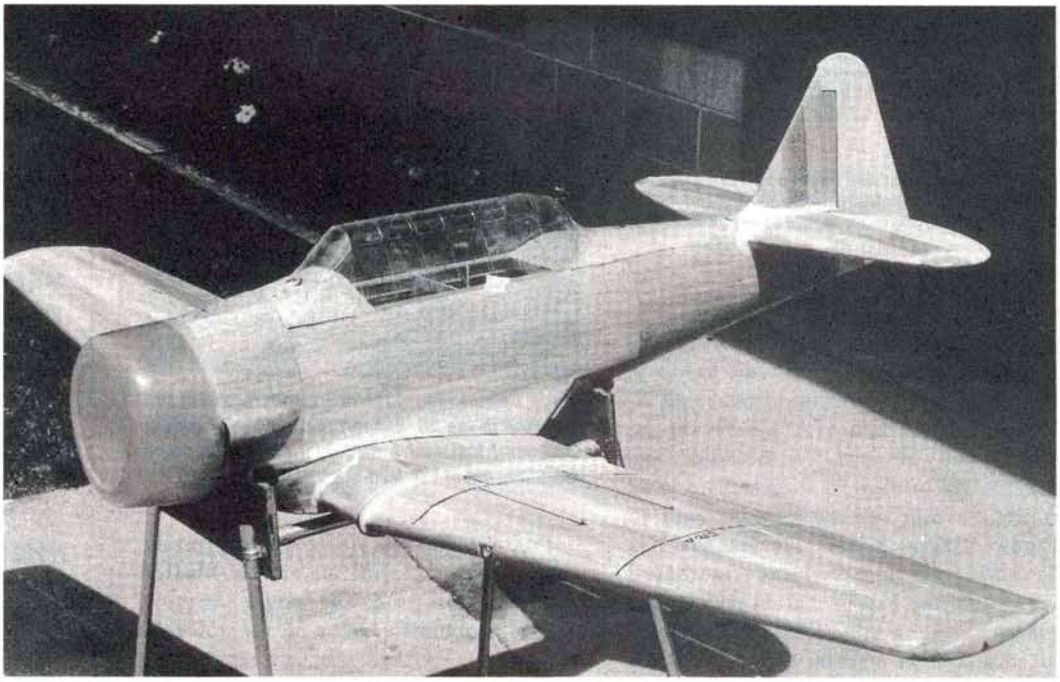
**Here are the addresses of the companies mentioned in this article:*

Twinn-K Inc., *4770 W. 139 St., Cleveland, OH 44135.*
California Carbon, *P.O. Box 39, Jamul, CA 91935.*
JR Remote Control, *distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821.*
Hobby Lobby International, *5614 Franklin Pike Cir., Brentwood, TN 37027.*
Webra, *distributed by Horizon Hobby Distributors.*
Master Aircsrew; *distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742.* ■

Aeroplane Works/Ziroli AT-6 Texan, Part 2

by FRANK PONTERI

How to apply a fiberglass finish in preparation for paint



As a follow-up to the Aeroplane Works/Ziroli* AT-6 Texan review that was published in the June '93 issue, I'll show you how I covered the model with fiberglass cloth in preparation for priming and painting.*

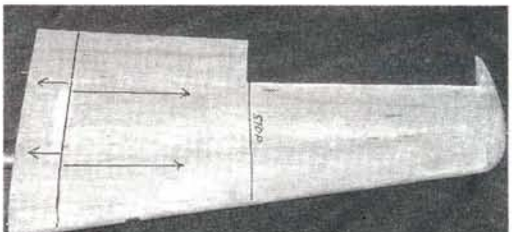
Supplies for Fiberglassing a Model

- Fiberglass: 0.06-ounce glass available from Dan Parsons Products*, (505) 296-2353
- Epoxy resin (used for paint base): West Systems no.105 Epoxy Resin, West Systems no. 206 Slow Cure Hardener available from West Marine, (800)538-0775.
- Straightedge razorblades
- Denatured alcohol
- 1-inch disposable paintbrushes
- 4-inch plastic squeegee

FIBERGLASS CAN BE used in a number of ways in the construction of a giant-scale aircraft. It can be used as a base for paint (which adds little or no strength) or it can be used as a bonding agent when additional strength is needed, e.g., when joining two wing panels, or installing bulkheads in a fiberglass fuselage. (See the list of the supplies for fiberglassing models as a painting base.)

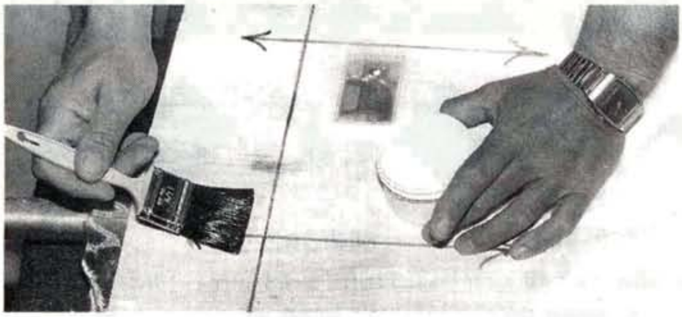
In my opinion, the most common error in first-time attempts to glass an airplane is leaving too much resin on the aircraft. Remember that all we want to do is fasten the glass to the wood and then fill in the weave of the cloth. We're not trying to create a plastic shell or a gelcoated surface such as on a fiberglass cowl.

If this is your first time, I suggest that you start with the wings. The wings are generally easier than the fuselage because there are no irregular or complicated curves to cover. Once you've covered the wings, you'll have gained enough experience to make covering the fuselage a little easier. It will be necessary to remove the retracts before glassing the bottom of the center section. Let's get started.

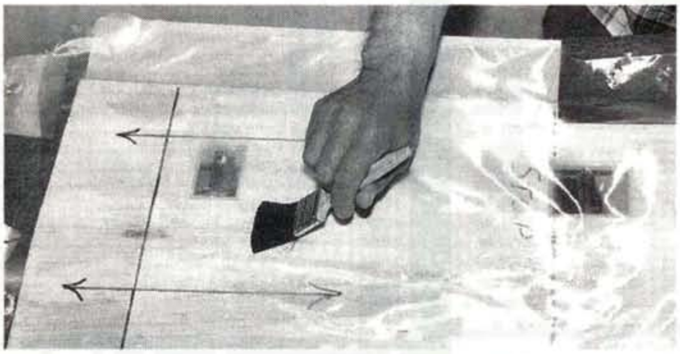


1 To cover the wing, I use .06-ounce glass and West Systems epoxy. It's important to remember that all dents must be filled before applying the glass. In addition, all seams must be sanded. I use Goldberg* Model Magic. When you're satisfied with the surface to be covered, remove all the sanding dust.*

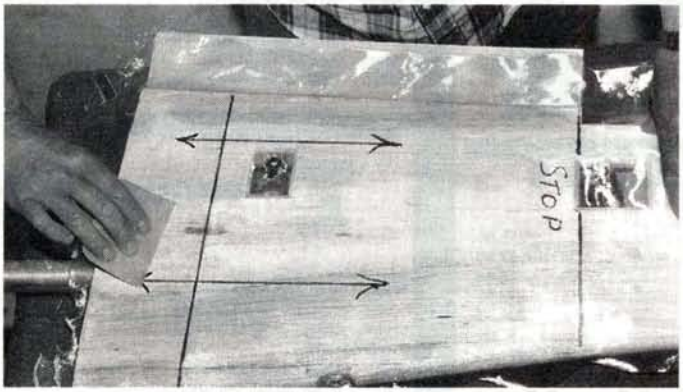
PHOTOS BY FRANK PONTERI



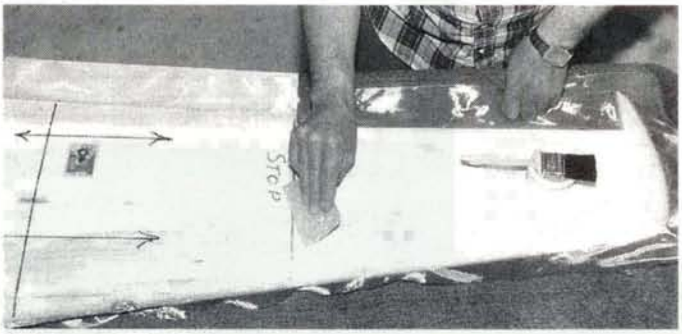
2 *I begin by covering the bottom of the wing. Cut the cloth slightly larger than the wing, leaving about 2 inches of excess all around. Lay the material on the wing, and use a soft, dry brush to brush out any wrinkles. Following the manufacturer's directions, mix about 2 ounces of resin and brush it on. I like to start about 4 inches from the root of the wing and work toward it. As you brush on the resin, the glass will become darker in color. Light spots indicate dry areas where more resin is needed.*



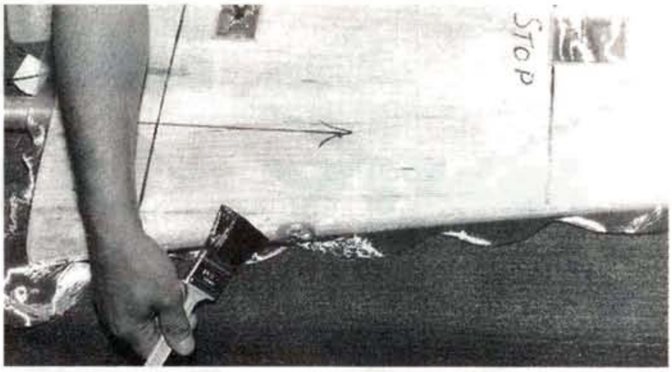
3 *Next, start brushing toward the tip, working from the center toward the leading and trailing edges. Brush out all the wrinkles as you go. Stop after you've completed half the wing.*



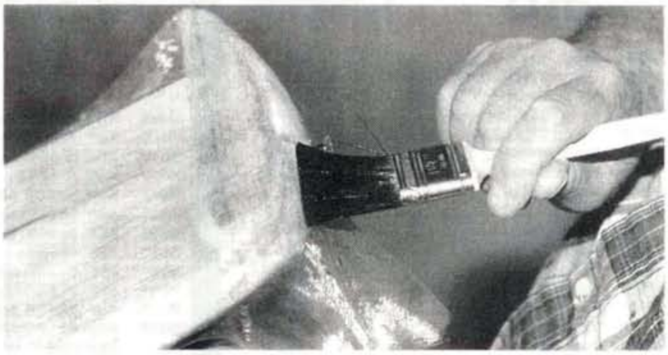
4 *Now take your squeegee and, again, starting 4 inches from the root end and working toward the root, squeegee out the excess resin. Be careful not to apply too much pressure because this will wrinkle the glass. Keep the grain of the glass parallel to the length of the wing. Clean up the excess resign using paper towels.*



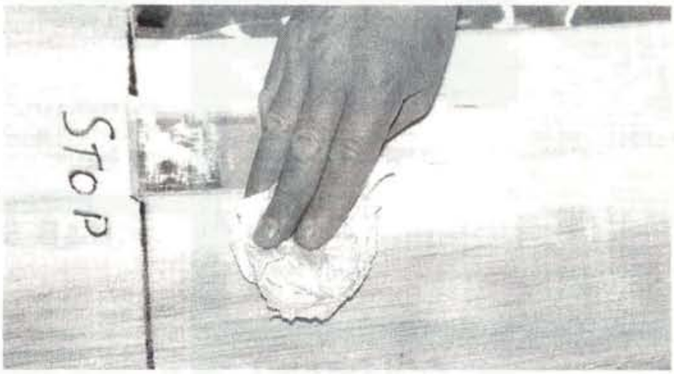
5 *Starting 4 inches from the root, squeegee the excess resin toward the tip, and use this resin to secure the remaining glass to the wing. When you run out of excess resin, use your brush to secure the remaining glass.*



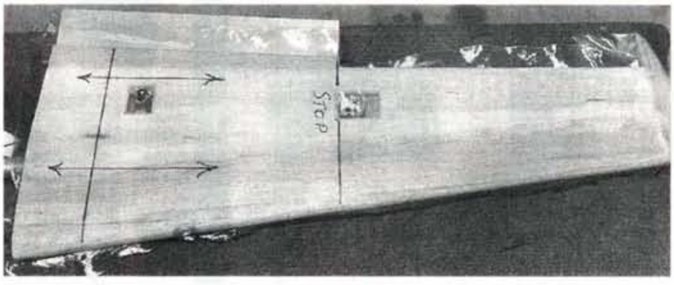
6 *Brush down the leading edge and tip, and wrap the cloth past the halfway point onto the upper surface. Working toward the tip, squeegee any excess resin from the outer half of the wing.*



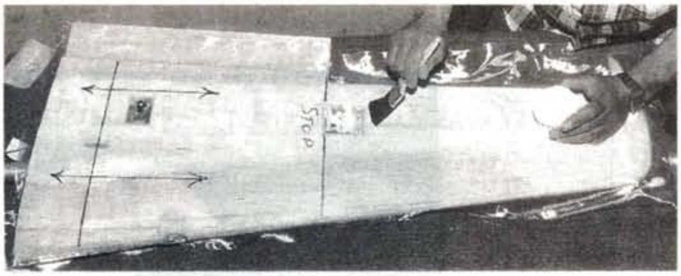
7 *As you do the tip, you'll notice that the cloth can easily be pulled into shape and smoothed down. If you have any wrinkles that won't be smoothed out with the brush, carefully slice the wrinkle using a straightedge razorblade, and overlap the cloth. Apply more resin, and smooth it out again.*



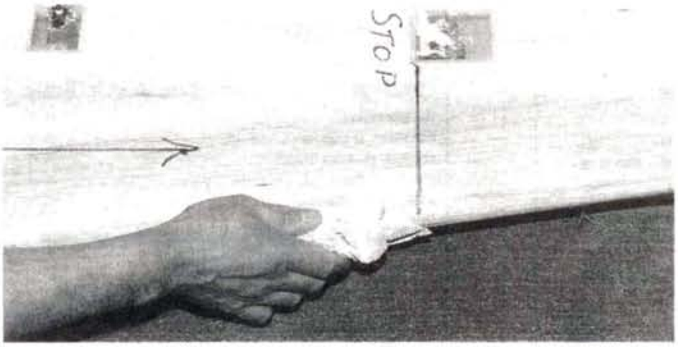
8 *Use paper towels to wipe away any excess resin not removed by the squeegee. Also wipe down the leading edge to remove the excess resin, and smooth the cloth. When you've completed this step, the wing should look dry with no glossy spots. Scan the wing, looking for spots of excess resin, and wipe them off.*



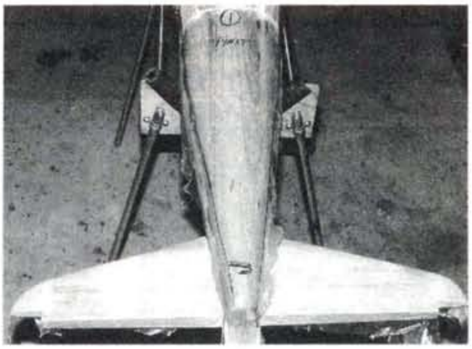
9 *Here's our wing with the glass applied. The bottom of the horizontal stabs can now be glassed using the same method. After the resin has dried, cut the excess glass off with a single-edge razor, then sand all edges using 220-grit paper. Glass the top of the wing panels, the top of the wing center section and the horizontal stab tops using the same method. When it's dry, clean up the edges. The flaps, the ailerons and the vertical stabilizer are glassed in the same way. I like to cut the glass for these pieces when I cut the glass for the bottom of the wing. If I have resin left over after covering the wing, I use it to cover the smaller parts, such as the flaps and the ailerons.*



10 *When all the parts are dry, sand them lightly using 220-grit sandpaper; be careful not to sand through the glass. You're now ready to apply the second coat of resin, which is applied in the same way as the first coat. Apply the resin only to half the wing using your brush; then use your squeegee to wipe the excess resin toward the tip, using the excess to second coat the outer half of the panel.*

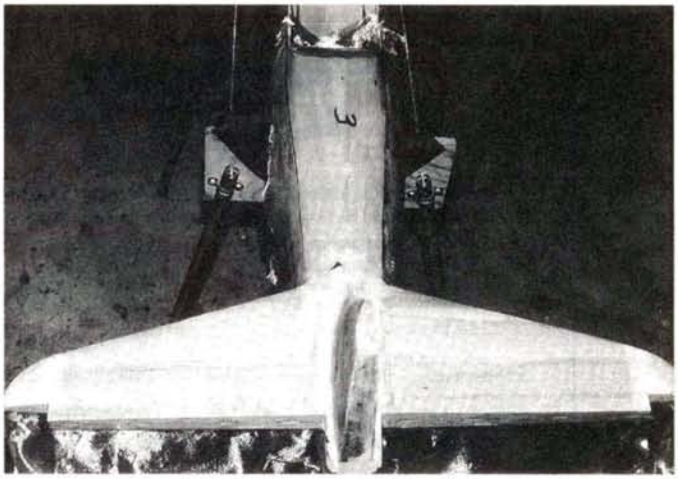


11 *When you get to the tip, wipe off any excess using paper towels. Go over the entire surface, including the leading edge, with paper towels to remove any remaining excess resin. The surface should be almost dry to the touch. You'll find that the second coat will require less resin than the first. Scan the wing for any excess resin and remove it. Second coat all the remaining wing parts.*

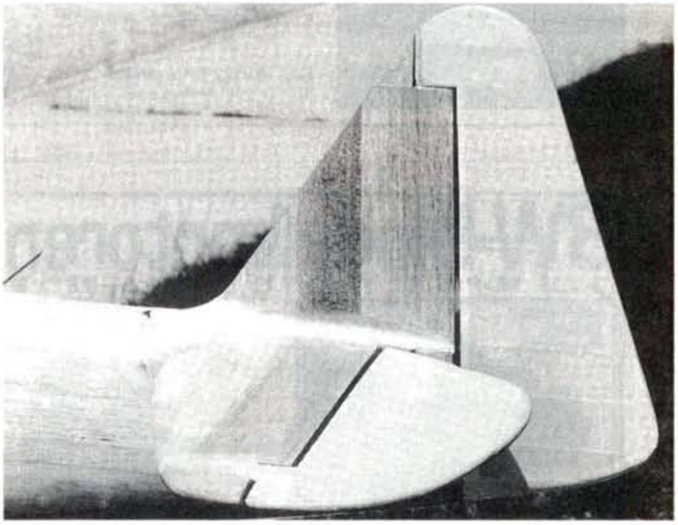


12 *Before starting the fuselage, the horizontal and vertical stabs should be finished as the wing was. The excess glass should be cut off where the stabs meet the fuselage. Start covering the bottom of the fuselage. Cut a piece of glass long enough to extend from the back edge of the wing saddle to the tail end of the fuselage and wide enough to go about 2 inches up each side. Starting at the wing saddle, secure the glass using your brush and resin. Pull or brush out any wrinkles as you go. Use your squeegee and towels to remove any excess resin. Work from the bottom center toward the sides, being careful not to wrinkle the glass. Because of the curves, most of this job should be done using paper towels. When it's dry, cut off the excess glass and feather-sand the edges on the side of the fuselage.*

13 *Cut two pieces of glass (one for each side) long enough to cover the area from the rear end of the balsa cowl extension to the tail end of the fuselage and wide enough to cover the area between the cockpit and the bottom piece of glass previously applied. The glass should extend to the bottom of the stab. Apply the glass to one side of the fuselage, overlapping the bottom edge of the cloth about ½ inch. Allow this side to dry, cut off the excess cloth, feather out the edges, and proceed to cover the other side.*



14 *When the resin on the second side has dried, clean up the edges as before and cover the top of the fuselage. The edges of the top cloth should overlap the top edges of the side pieces about ½ inch. After all the resin has dried, sand the entire fuselage and the stabs using 220-grit sandpaper, removing any lumps, bumps, or excess resin. Remove all the sanding dust from the surface. Take care not to sand through the glass. Feather out all the edges where the glass overlaps. You're now ready to apply the second coat of resin to the fuselage and the stabs. This can be done in two applications: first, the bottom, going up to and including the bottom of the stab, and when that's dry, the top of the fuselage down to the top of the stab.*



15 *Final sanding of all the glassed parts should be done using 220-grit wet paper. When you've finished sanding, you should see no glossy spots. If you find any dry spots, touch them up with a little resin, and when it's dry, sand again. Areas such as the inner side of the flaps, or the plywood servo covers do not have to be glassed. I apply one coat of resin to seal the wood, followed by a little light sanding. Fabric-covered parts, such as the rudder and the elevators, are covered with Sig* Koverall and dope. The aircraft is now ready to prime.*

In Part 3 of this series, I'll give you the particulars on priming and painting the Texan, applying the graphics, the flight performance and the final installation of the hardware. Up to now, the weight of the model, including the engine, the retracts and air tank, the servos, etc., is 21 pounds. Not too bad for a model of this size with a fiberglassed finish.

**Here are the addresses of the companies mentioned in this article:*
The Aeroplane Works, *2134 Gibride Rd., Martinsville, NJ 08836.*
West Systems, *Weston Aerodesign, 944 Placid Ct., Arnold, MD 21012.*
Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.*
Sig Mfg. Co., *401 S. Front St., Montezuma, IA 50171.*
Dan Parsons Products, *11809 Fulmer Dr. NE, Albuquerque, NM 87111.* ■

R/C VTOL

(Continued from page 41)

because my vision was fixed on the model, and I found it impossible to include the terrain for reference. It happened to be a cloudless day, too. Bear in mind that I had to concentrate full-time on controlling all the axes. The only thing I do remember is that it seemed to take about 3½ days to get to the ground. After I did get close to the ground and made a somewhat clumsy and hard landing, I felt exhausted.

Since then, I've flown the model many times with no serious upsets. It gets easier each time. However, on one occasion, one of the engines failed during the transition into the hover, but I was lucky enough to have Larry Jolly with me as my security pilot. All I could see was the model descending in a vertical spiral dive, so I pulled back on the stick "to make the houses get smaller," and I was told later that it did a loop. I quickly deployed the engines back to horizontal and handed the box to Larry, who then took over the controls. At that point, the second engine quit, so Larry landed it dead-stick (successfully, I may add). We didn't fly anymore that day.

THANKS TO ALL WHO CONTRIBUTED

Altogether, it was a very satisfying program. Thanks to the AeroVironment design staff for a great flying aircraft; Bob Kress, Grumman consultant and president of Kress Jets Inc., who provided voluminous amounts of great wisdom during the whole program; Martin Burden, Grumman's program manager; Grumman's Tom Hunt, who helped with the first transition tests; and for the cooperation and help of the greatest model club I've ever been a member of: the Channel Islands Condors of Camarillo, CA.

**Here are the addresses of the companies mentioned in this article:*
JR Remote Control; *distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
Hurricane Fans, *14835 Halcourt Ave., Norwalk, CA 90650.*
O.S. Engines; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826*
Astro Flight Inc., *13311 Beach Ave., Marina Del Rey, CA 90292.*
Master Airscrew; *distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742.*
Du-Bro Products, *480 Bonner Rd., Wauconda, IL 60084.*
Rev-Up; *distributed by Progress Mfg. Co., P.O. Box 1306, Manhattan, KS 66502.* ■

VIDEO VIEWS

(Continued from page 37)

made us laugh out loud. The sequence that shows the advantages of a buddy box over a single, shared transmitter for teaching R/C flying is quite effective.

Like all the AMA films, it's a professional

(Continued on page 64)

VIDEO VIEWS

(Continued from page 63)

production, and it retains its usefulness as an introduction to our sport for newcomers, or as a historical review for the experienced modeler. Besides, we all love seeing fine models in the air, which is as good an excuse as any for buying this video. ■

AIRWAVES

(Continued from page 9)

DYNO MYSTERY

I've read Mr. Dave Gierke's articles and look forward to many more. The dynamometer data is helpful, and the data from the airborne tests are outstanding. Several of our club members are interested in the homemade dynamometer Dave Gierke uses. I have some idea of how it was built, but the details are hazy, especially calibration and the actual engine-mounting technique used. I suppose a new mount could be attached for each engine, but that would surely make re-calibration necessary each time.

Mr. Gierke says you will be publishing some material on the effectiveness of silencers. Very good; we have a dB meter and are using it to experiment with the sound that's generated by our engines. We hope to get a flying site on a landfill that will be closed in a few years, but it's only a few miles from a residential area. I've done some calculations as to the dB level at the closest home with three and four .60 size engines running at a 100-foot altitude. The numbers are good, but numbers don't always win with irate citizens.

During WW II, I used to get my *Model Airplane News* in Italy, and I would occasionally build an airplane between missions. It was a fine magazine then, but it's much better now. I had to make a living, so model airplanes took a backseat until I retired. Now a bunch of us old duffers are trying to catch up. We really like the how-to articles like "Vacuum Forming Canopies." There are many new materials, construction techniques, etc., that we would use, but we just don't know about them.

HENRY A. HAIN
Green Valley, AZ

Thanks for your comments, Henry. We're always pleased to hear from long-standing readers. Dave Gierke notes that he uses a radial mount for front-intake engines, and beam mounts for rear-intake engines (the beam is mounted to the radial adapter). He recalibrates his dynamometer before every engine test (see the sidebar in his Saito FA-50 test, reported in our August '93 issue).

Dave is testing some of the quietest mufflers to develop some data on this subject. He has some interesting results to report, which you will see in upcoming issues. As for our emphasis on how-to articles—we plan to continue to publish articles that explain building and construction techniques, using both traditional and new materials. We rely on our readers to provide this kind of material, so any readers who would like to contribute should contact us at the address or the fax number noted in the answer to the preceding letter! TA

STEALTH WORKBENCH

I received the August issue last Friday and had read the whole thing by Saturday. I guess I like your magazine. I think the solution would be to double its size and then it would take me longer to read! I was amazed when I turned to page 88 and saw an article on Lon Turner's building mate workbench. I've been building this way for years in my bedroom. I have the cheapest model of the Work-Mate™ and it works just fine. I do have an improvement that will make the top more steady. Instead of the single cleat, use two that are spaced ¼ inch less than the full opening width of the jaws. This means that the table will be open to its max and thus be much more steady and less

(Continued on page 94)

The rising popularity of the T-6 Texan class has resulted in four races. Leslie Gillett flew 31.4-pound Race 052 to a first-place win in Bronze.

Racers battle nature and each other for their share of $25,000

F
T

Classical Racing Team's X84 is all business as it touches down after winning its first Silver heat race. A little heavy at 38.5 pounds, a strong Webra 4.4 engine and clean aerodynamics ultimately resulted in a fifth-place Gold trophy win for the DW Aircraft Roto-Finish.

Duke Crow's Race 99 on final after qualifying. The veteran pilot's bid for the Gold winners' circle was crushed when the 49-pound racer apparently experienced radio failure and fell out of the first turn in an early heat race. The Aerrow 200s-powered Stiletto was completely demolished.

Left: Rodger Grotheer's 30.3-pound "Texas Red" under intense scrutiny by a RUMARA official. Technical inspection very stringent. Race 13 took home a fourth-place Gold trophy and a check for $697.

Dick Sizer won Best of Scale and Pilot's Choice in the Unlimited Class. His hopes for the Gold were dashed once again when his gorgeous, but overweight, Starr Cobra torque-rolled in during qualifying. The 51.4-pound P-63 sported a 17-pound twin Husqvarna engine custom built by Sizer and the Challenger Machine Co.

irst Reno Unlimited -6 Giant-Scale Races

by ROB WOOD

PHOTOS BY ROB WOOD

Roll Tape! The Skyfire camera crew records Paul Curley's control check of the third-place Silver Excaliber. Skyfire also produces an annual video of the full-scale Reno Races.

THERE'S A SAYING in Reno: "If you don't like the weather, wait 10 minutes." There was a lot of waiting at Stead Airport last June because during much of the five-day race, the weather remained doggedly miserable. The pilots and crews of 25 Unlimited and 21 T-6 entries seemed willing to put up with just about anything as they vied for a guaranteed purse of $25,000, but even giant-scale models with powerful engines don't do well in 25mph crosswinds. At one point during the heat races, competition was halted because of a brief, but fierce, hailstorm. Pea-size hail quickly covered the pits and runway—great for snowball fights, but not exactly conducive to racing. Luckily, the weather did cooperate on Friday with blue skies, mild temperatures and gentle breezes, and racing conditions were just about perfect. Although Sunday's trophy races were cancelled because of rain and 37-degree temperatures, some important developments occurred that deserve attention.

(Continued on page 71)

Canadians continue to go the distance at the Unlimited races. Owned by Al Wardell, this stock 42.7-pound Mustang was piloted to a second-place Silver slot by Frank McCrindle. Despite a strong 7.4ci Stihl engine, the 37-degree temperature and the 5,000-foot altitude reduced performance and speed.

Classical Racing Team's 31-pound Stiletto took second place in Gold. Built from Ziroli plans, Race 84 is a veteran of three Unlimited races (Madera '91, '92 and Reno '93), with over 55 flights. This 22.5 percent scale model—a replica of the '84 Reno National Champion—features sequencing inner/outer gear doors, a 4.4ci Webra engine and graphics by Butch Andrews of Model Graphics.

FIRST R/C NATIONAL CHAMPIONSHIP AIR RACES

The idea was a natural: hold giant-scale, Reno-style air races at the site of the full-scale Reno Air Races. Use the same facilities and the same rules. Reno Air Racing Association (RARA) executive director Thornton Audrain asked Doug Bevard (event coordinator of this year's model races) if giant-scale model races could be held at Stead Airport. Bevard has arranged other scale-model flying demonstrations at the full-scale races, and he promised to look into it.

After considerable research, which included discussions with Michelle Boland (director of the Scale Air Racing Association), officials at AMA District 10 and the promoters of previously held giant-scale races, Bevard informed RARA that he saw no problems. After forming the Reno Unlimited Model Air Racing Association (RUMARA)—a nonprofit corporation—Bevard, his wife, Denise and some friends set out to turn the idea into reality.

Scott Manning's JP350 was arguably the fastest racer at Reno '93, but it was a handful to fly. The 11-pound, .90-powered Rossi racer was the only one of three JP350s entered that qualified for a slot in the Trophy races.

RULES CONFLICT

According to Denise Bevard, administrative coordinator for RUMARA, RARA and full-scale Reno racing enthusiasts were adamant about wanting all entries to be sized according to full scale. In other words, all entries had to be 22.5 percent of scale (or larger), so that the models would be in scale proportion to one another. Unfortunately, all previous races had been based on a 100-inch-wingspan minimum—*not* on a particular scale. As a result, the only existing racers that could cross over competitively were 100-inch-span Mustangs (which just happen to be 22.5 percent of scale). The difference in size requirements meant that most racers, plans and kits designed for Madera either were not legal at Reno, or would be too large to be competitive.

The second conflict involved aircraft type. While all previous races had allowed only models that qualified at the full-scale Reno races, RUMARA rules allowed any piston-powered military aircraft built after 1939 to be used as a subject, as well as any custom-built, racing aircraft that qualified for Reno. This rule opened the door to hundreds of possible subjects, some of which would be tiny compared with "heavy metal" warbirds that were built in 22.5 percent scale.


Dan Gray brings his DW Aircraft "Classical Stiletto" in after a qualifying run. Although his opposed-twin 6ci 3W engine wasn't performing well, he still managed to land the first-place Gold trophy. Dan and his team will be major contenders at Madera '93.


Despite miserable weather, CD Doug Bevard kept the Reno races moving smoothly throughout the week.

As an example, Dave Abbe, Kent McKenna and Scott Manning (all veterans of previous races) showed up with 50-inch-wingspan models of the JP350, an experimental home-built racer that qualified for Reno. The general feeling in the model racing community was that the JP350-size airplane would win the races, since it could be built under 9 pounds using a Rossi .90 for power.

The third conflict involved RUMARA's emphasis on scale outline, finish and craftsmanship. Scale judging accounted for up to 20 percent of the total points needed to qualify for the trophy races. Previous races had taken a somewhat loose

FINAL UNLIMITED STANDINGS

Place	Pilot	Race No.	Model	Weight	Engine	Disp.	Fuel	Time	Radio	Prop	Cash Prize
GOLD											
1st	Dan Gray	Race 1	Stiletto	34.7 lb	3W	120cc	gas	38:09	Futaba Bolly	20x20	$2,688
2nd	Bryan Keil	Race 84	Stiletto	31.5 lb.	Webra	75cc	alcohol	43:00	JR	APC 20x16	$1,888
3rd	Scott Manning	Race 41	JP350	10.75 lb.	Rossi	15cc	glow	38:10	Futaba	APC11x11	$1,808
4th	John Krohn	Race 72	Stiletto	35.85 lb.	Aerrow	100cc	gas	43:44	Futaba	Zinger22x18	$1,760
5th	Mike Boso	Race X84	Roto-Finish	38.lb.	Webra	75cc	alcohol	51:11	JR	APC 20x16	$1,728
SILVER											
1st	Mike McCrindle	Race 55	P-51H	54.35 lb	Stihl	122cc	gas	54:16	Futaba	APC 22x18	$1,712
2nd	Frank McCrindle	Race 25	P-51D	42.7 lb.	Stihl	22cc	gas	54:41	Multiplex	APC 22x18	$1,408
3rd	Paul Curley	Race 1	P-51	29 lb.	Sachs	5.8ci	gas	56:77	Futaba	APC20x16	$1,376
4th	Leonard Norred	Race14	P-51	35.1 lb.	Sachs	4.2ci	gas	53:92	Futaba	Zinger 20x12	$1,344
5th	Dan Egelhoff	Race 96	P-51	47.85 lb.	Quadra	100cc	gas	1:00:28	Airtronics,	Zinger 21x14	$1,312

approach to the subject of scale: just stand way back and squint. Many felt that scale judging was for Scale Masters events and that racing should emphasize speed and flying skills. In the words of Paul Ross, owner/builder of Madera '93 Unlimited Gold winner 00, "I'm not going to any beauty contest!"

Although these conflicts may have limited the number of entries, the concept of giant-scale racing at Stead Airport is an exciting one, and the racers who attended were dead serious about competing for the $25,000 guaranteed purse. Thornton Audrain said that this year's race was a success and that RARA has already set a date for next year's race. He will work with RUMARA and the rest of the racing community to bridge the gap in the giant-scale rules. One thing is certain, though: giant-scale racing is here to stay!

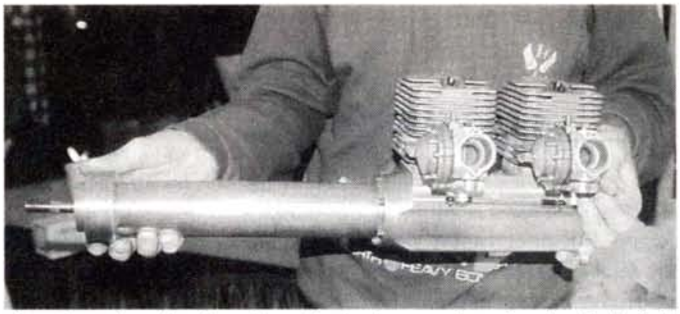
THE RACES

Even though bad weather reduced the number of heat races (and cancelled the trophy races), the full purse of $25,000 was awarded based on accumulated points. There was some exciting racing at Reno, with quite a few close bouts in Unlimited as well as T-6 classes. All T-6 racers qualified within a few seconds of one another, while Gold Unlimited leaders traded places throughout the heats.

APC's Fred Burgdorf poses with one of the Reno '93 pace planes. Unlike previous Unlimited race pace planes, this one had no trouble keeping the speed up for the Gold Class. Fred modified the 7.5-pound EZ King Cobra with a composite shell wing, fin and rudder. Built for the .60-size Scale Warbird Racing circuit, the Cobra features a YS .61 with a Max Tuned quiet pipe, APC (naturally) 11x12 prop, retractable gear and pattern control setup.

UNLIMITED

From the first, the JP350s were considered the major contenders for the Gold in the Unlimited races. Of the three, Kent McKenna put his plane into the tarmac early on, and Dave Abbe's entry was withdrawn after repeated damage during takeoff attempts. Only Scott Manning, flying no. 41, was able to compete consistently. Throughout the heat races, Manning's Rossi-powered JP350, Dan Gray's Classical Stiletto with its 3W twin and Bryan Keil's Webra 4.4-powered Stiletto continually shifted from first to second to third place in the standings. Because the trophy races were cancelled, the fastest of these three racers has yet to be determined.



If you're not pushing the edge of technology, you're not racing Unlimited! Dick Sizer's 17-pound in-line twin featured two 6ci Husqvarna cylinder/pistons, a custom-machined case and an extension shaft so that it could be mounted rearward of the front end for balance. The engine sounded like a Formula 1 Indy racer at full throttle. Look for it in a Mustang at Madera '93.

Qualifying times were slightly slower than previous races, mostly because of the 5,000-foot altitude. Of the 25 registered Unlimited racers, only 13 managed to qualify. Three of the qualifiers crashed or were withdrawn during the heat races, and this left 10 for the trophy races. These were divided evenly into Silver and Gold categories. All 10 took home prize money.

Scott Manning's 50-inch-span JP350 won the award for best technical achievement. To qualify at Madera, the span would have to be stretched to 100 inches and the fuselage length would be more than 12 feet!

AT-6 RACES

The popularity of AT-6 giant-scale racing is growing at an amazing rate. This year, T-6 races were scheduled for Reno, Houston, the Aviation Expo and Madera. The phenomenal growth of the T-6 races is understandable, given the relatively small investment of putting a T-6 together (approximately $1,000 to $1,200), the restrictions on weight (25 to 40 pounds), the stock engine (G-62), the relatively slower speeds and the very close races. It's not uncommon to see three or four Texans turning the pylons wingtip to wingtip throughout a race, and the crowds eat it up!

As an example of just how close many of these races have been, take a look at the following breakdown of heat number four in round two:

- first—race 60; pilot: Chuck Winter; time: 2:44:38; penalties: 0
- second—race 4; pilot: Joe Marine; time: 2:47:16; penalties: 0
- third—race 13; pilot: Rodger Grotheer; time: 2:47:16, penalties: 0

Marine and Grotheer finished at the same time, less than 3 seconds behind Winter! Second and third places had to be determined by qualifying scores. Incidentally, Winter went on to take first in Gold for the meet, while Marine and Grotheer took home the third- and fourth-place Gold trophies. That's racing!

AT-6 "Go-No Go" gauges, produced by Nick Ziroli, Sr., were used by race officials during inspection. Simple to use, the gauges guaranteed compliance with minimum airframe dimensions as specified in the rules. Rigid adherence to minimum specs results in very close races for this class.

NEW ENGINES

Two new engines made their debut at Reno '93. Webra's long-awaited, 4.4ci, single-cylinder engine was flown by Bryan Keil and Mike Boso of the Classical Racing Team. Although smaller than most Unlimited engines, the engine is a powerhouse, swinging an APC 20x16 at 8,500rpm static. The Webras took second- and fifth-place Gold trophies, and they'll be modified for Madera '93.

The second engine introduced this year was an awesome 12ci in-line twin produced by Dick Sizer of Starr Aircraft and Challenger

T-6 TEXAN FINAL STANDINGS

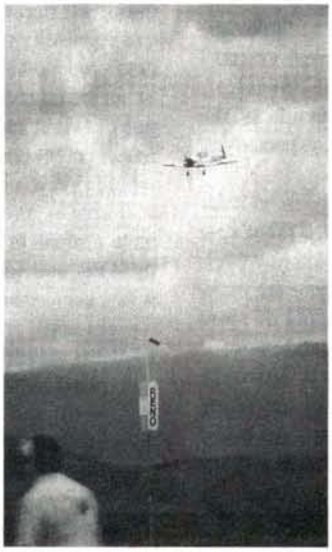
Place	Pilot	Race No.	Weight	Radio	Cash Prize
GOLD					
1st	Chuck Winter	Race 60	33.5 lb.	Futaba	$1,160
2nd	Shawn Whisman	Race 33	30.9 lb	Futaba	$757
3rd	Joe Marine	Race 4	27.4 lb.	Airtronics	$719
4th	Rodger Grotheer	Race13	30.35 lb.	Airtronics	$697
5th	Fritz Harrold	Race 82	26.65 lb.	Futaba	$682
SILVER					
1st	Brian Vaillancourt	Race 555	27.8 lb.	JR	$676
2nd	Rick Maida	Race 19	31.65 lb.	Airtronics	$534
3rd	Charles Langdon	Race 41	33.55 lb.	Airtronics	$519
4th	Charles Brown	Race 15	28.2 lb.	Futaba	$504
5th	Fred Burgdorf	Race 75	26.8	Futaba	$489
BRONZE					
1st	Leslie Gillett	Race 052	31.4 lb.	Futaba	$459
2nd	Joe Pierson	Race 14	27.35 lb.	Airtronics	$347
3rd	Marty Wittman	Race 51	30.7 lb.	Airtronics	$235
4th	Kent McKenna	Race 216	30.5 lb.	Airtronics	$198

Machine in Minnesota. Although Dick's 50-pound+ P-63 crashed on takeoff, the engine survived. Dick's new P-51 Stiletto and this engine will be at Madera.

NEW KITS

A new Stiletto and a new Roto-Finish kit made their debuts at Reno. Produced by DW Aircraft, the planes have a lightweight, composite fuselage with sheeted, foam wings. The Classical Stiletto, flown by Dan Gray, took first place in Gold, while the Roto-Finish took fifth place in Gold with Mike Boso on the sticks. Both kits are available as a basic fuselage and core, or fully sheeted and ready to cover. For more information, contact Dwight Warner, DW Aircraft, 409 Mid Pines Way, Modesto, CA 95354, (209) 522-7597.

As the interest in giant-scale racing continues to grow, it's crucial that an association of racing enthusiasts develop at the same pace. GSARA (Giant-Scale Air-Racing Association), which grew out of the Madera races, now has more than 180 members in Canada, Mexico, Germany and the United States. ■



Chuck Winter brings first-place Gold T-6 (Race 60) in on final after edging out Joe Marine and Rodger Grotheer by less than 3 seconds in round two. Unfortunately, the 33.5-pound Pilot's Choice was totalled in the AT-6 races at Houston, two weeks later.

RACE ASSOCIATIONS

RARA, c/o Thorton Audrain, P.O. Box 1429, Reno, NV 89505; (702) 972-6663.

GSARA, c/o David Bridi, 1744 Greenwood, Torrance, CA 90503; (310) 212-3257.

RUMARA, c/o Denise Bevard, 6801 Flower St., Reno, NV 89506-1712; (702) 677-0869.

The Unlimited, c/o Lesley Burnett, P.O. Box X, Torrance, CA 90507; (310) 320-8369 (Unlimited and T-6 races at Madera).

Aviation Expo, c/o Joe Schumacher, P.O. Box 498, Ankeny, IA 50021; (712) 364-3167 (T-6 racing).

Houston R/C Air Races, c/o Wiley Brown, 9114 Bent Spur Ln., Houston, TX 77064; (713) 469-6460.

MITCH POLING

DURATION AND SPEED 400 RACING

DURATION ELECTRIC FLYING

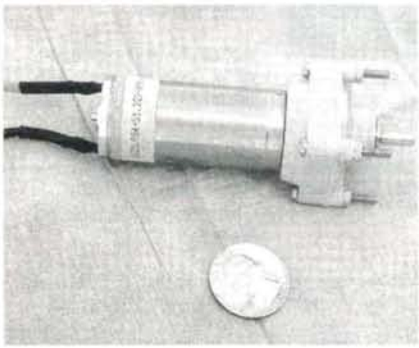
I AM LIVING in Germany while my wife serves as a physician in the U.S. Air Force. One of the benefits of living here is the very active electroflight scene. Electric fun flys and contests run all year round, even in February! The activities include almost every aspect of electrics that can be imagined. Electric helicopters, solar flight, pattern, scale, duration and pylon racing are all covered. I became interested in duration thanks to an excellent book by Helmut Bruss on solar electric models. This book is outstanding; I recommend it if you are interested in either duration or solar flying. It's published by Aichstetten VTH*, price DM 28 (about $18). It's in German, but the photos, tables and illustrations are so extensive that it's quite useful, even if your German is limited.

This past year, more equipment has been available for solar and duration flying. I mentioned the Jamara* DH 1 solar motor in the June column; I have an Interelectric* RE 025-055-35EAA motor, which is equivalent. This motor has a coreless design with neodymium magnets and silver brushes. It weighs 130 grams, and is up to 88 percent efficient. I've been flying this motor quite a bit in my own duration design—the Chronos ("time"). One hour and 15-minute flights are routine with this motor, the Schoeberl* Moskito prop and 14 Panasonic 1700mAh cells. The prop is up to 80 percent efficient, turns 1,600rpm on a Marx Pile 6:1 planetary gearbox and draws 2.0 amps. I find that the Panasonic Red Amp Plus cells are rated conservatively, at least at lower currents. My SR* Super Charger rates these cells at 1900mAh at a 1.0A discharge rate.

The Chronos weighs 4 pounds with a 270mAh receiver pack, two miniservos, a regular-size receiver and an Astro Flight* 205 speed controller. It has an 80-inch span, an area of 880 square inches and a wing loading of 10.5 ounces per square foot. The plane flies on 35W input. This is about the same as a Cox* Pee Wee 020 glow engine. It climbs slowly but steadily—about 40 to 60 feet per minute—and my usual flight altitudes vary between 50 and 500 feet. The flights are on a continuous motor run; that is, I don't turn the motor off. The flight time is on power alone—no thermal assist. I have used thermals, but the downdraft that's encountered on the outside of the thermals cancels out the gain, especially at the lower altitudes.

The Schoeberl Moskito prop for duration flying has a very high efficiency at 1,200 to 1,600rpm.

An hour and a quarter seems to be it for the plane as it is. When it lands, there's no charge left in the pack. I hear, however, that other fliers here in Germany are making continuous motor run flights of more than two hours on regular Ni-Cd packs—not fancy one-shot batteries. Most are doing it by carrying two packs and using them in parallel, or by switching from one to the other. If the Chronos could carry two packs, it could possibly fly up to two and a half hours on motor power alone.



This Maxon (inter-electric) solar and duration motor has a factory number of 2625.984-51.222-000.

AIRCRAFT PERFORMANCE FACTOR

In the May 1993 issue of *Model Builder*, Roger Jaffee proposed an aircraft performance factor, or ratio (APR for short) for evaluating the potential performance of electric aircraft. The APR is the power loading (watts/ounce) divided by the wing loading (ounces/square feet). Roger has found from experience that models with ratios above 0.15 perform well. The Chronos is way under this line: its power loading of 0.55 watt/ounce divided by the 10.5 ounce/square feet of wing loading gives an APR of 0.052. The combined efficiency of the motor and the prop is about 70 percent—almost twice that of ordinary electric aircraft systems. The delivered power is probably equal to that of an ordinary 60W system; this would put the APR closer to 0.09. Chronos represents an extreme, and I think most pilots would find it a challenge to fly.

There is another use for APR. If you have a plane that works, you can calculate its APR and use that value to see which wing area would let it fly at a higher weight with the same power unit. The Chronos would weigh about 5.8 pounds with two 1700 Panasonic 14-cell packs (28 cells total) and the additional weight of a larger wing. The calculation is: square feet = weight squared x APR/watts. *[Editor's note: for this example, Mitch listed the weight as 5.8 pounds, or 93 ounces. The APR is 0.052 with a 35W power system.]* The Chronos would need 13 square feet (1,860 square inches) of wing area to fly. I build wings in sections of plug-together panels, so the change was easy. I built two more panels for an additional 6 feet of span. I then flew the Chronos with two packs and the original wing, then with one new panel (116-inch span) and with two new panels (152-inch span). The APR works! At 5.8 pounds, the Chronos did a flat glide and landing with the 80-inch span; a constant launch height circle and

PHOTOS BY MITCH POLING

landing with the 116-inch span; and climbing flight for several circles with the 152-inch span. I think it may well be able to do sustained climb, but the wing was not designed for such a span and bows to an extreme, which makes it very touchy to fly. So, some wing structure redesigning is the next task.

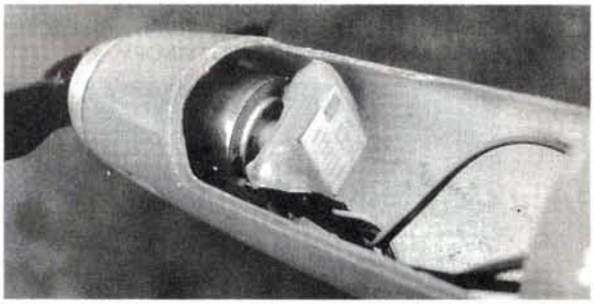
DURATION RECORD

Doctor Josef Hackstein holds the current German electroflight record—9 hours, 48 minutes—covering 240 kilometers on a closed course. He used non-rechargeable batteries for this record. His plane weighed 1,845 grams (4.1 pounds), had a span of 2.5 meters (98 inches) and a wing area of 39.2 square decimeters (607 square inches). His Sunriser is quite a bit smaller than the Chronos. This suggests an alternative approach to very long duration. I think that the Sunriser will fly on only 1 amp (15 watts). If that's correct, a

The Mini Race Cat.

single 1700 Panasonic Red Amp Plus pack could fly it for over 2 hours. Jamara sells the Sunriser as a kit (order no. 020020, about $85). The construction is straightforward, conventional balsa technique; the plane is a twin boom pusher. Anyone who has built a 2-meter glider should be able to build it. Jamara also sells a special duration motor that looks the same as the solar motors, but it has a duration winding. It's Elektromotor DH1 Langstrecken (order no. 13 7013, about $305). You will also need a 6:1 Marx gear reduction and a Schoeberl Moskito propeller. There you are: now you, too, can fly over an hour on a single charge!

Electric duration has come a long way in the last three years. I think these developments will lead to much longer flight times for all electric planes. Motor run times and flight times on regular Ni-Cd packs will be in the half hour to 45-minute range with no thermal assist. Electrogliders, old-timers and sport designs will be ideal for this type of flying. However, the "All Up Last Down" events will be in trouble! The AULD winners will have to fly at least one hour—more likely an hour and a half, to win. This will probably lead to a change in AULD to a limited motor run to keep flight times within reason. Fly longer, fly electric!



The on/off and BEC Schultze S-10 is mounted on the back of the Graupner 400 motor.

SPEED 400 RACING

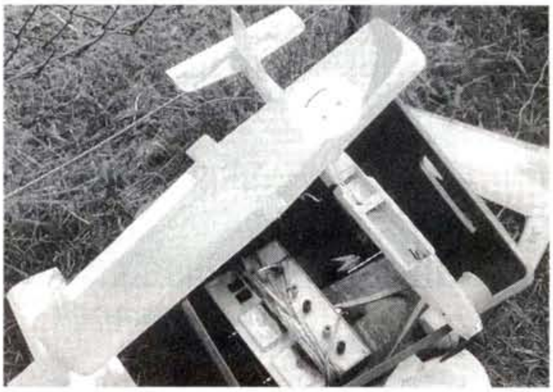
As I mentioned, there are even electric meets in February. The Bad Nauheim meet is organized and run by Charlie Binder. I met Charlie in 1978 at an Astro Champs meet in Los Angeles. Charlie was a flight engineer for Lufthansa, and he brought an F3E model to fly at the meet. It climbed at a 50-degree angle and was at 800 feet in 30 seconds—awesome performance at the time and still pretty good! Charlie is now retired, and he flies a scale Lockheed Constellation that he designed and built over two years. It weighs about 40 pounds and flies on 48 cells. It's a magnificent sight in the air.

Charlie is brave to schedule a mid-winter meet, but it's very popular, and more than 100 pilots signed up for both Saturday and Sunday. The weather varies from snow to spring-like sunshine. This year, it was foggy on Saturday, and you could see about 500 feet. Luck was with Charlie, though. He had scheduled the electric helicopter task flying and Speed 400 racing for Saturday, and the fog wasn't a problem. The full day's schedule was flown without a hitch. Sunday was springlike—just right for the duration and sport-glider events!

Speed 400 racing is special; the planes are small—in the 25-to 28-inch-span range—and they have a limit of seven cells and a Graupner Speed 400 motor. The flying weights are from 500 to 600 grams (18 to 21 ounces). The course is much smaller than the usual courses: it's a 300-meter (328-yard) triangle with a 40-meter (44-yard) base and 130-meter (142-yard) sides. Flight speeds are 45 to 60mph. Now you see how the races beat the fog! This kind of racing is inexpensive (the motors cost less than $15) and you can build a competitive plane from balsa for very little cost. You can, of course, build the plane from fiberglass or carbon, but the edge in Speed 400 is pilot ability—not technology.

AT THE RACES

Let's cover a race in detail to give you an idea of how it is done. I went to the Menzelener Modell Club Speed 400 race, near Dortmund, in May. It was perfect summer weather and the grass club field is in pretty countryside much like Holland



This is a close-up of the Race Mouse interior. It has one alieron, one bolt for the wing and dowel at the leading edge, a receiver and an elevator. The servo is at the rear of the cabin, and the speed controller is in the nose behind the motor. The model has a 3-channel radio, an aileron, an elevator and a motor. The Graupner spinner is popular.

M. Markus and his design, the Race Maus (Mouse). It's a very smooth flier, and it's good for holding a tight course. (It won first place.) The plans are available from Modell magazine.

(including windmills and canals). The triangular course was marked out with three, 15-foot-high, wooden poles wrapped in barber-pole, red-and-white plastic tape. Two people at each pole watched for cuts (flying inside the triangle) and flagged any cut to the scorer, who was stationed in the pit area. The scores were recorded on a 3x4-foot white cardboard sheet. After three rounds had been flown, each pilot's lowest score was dropped. The pilots stood at the base of the triangle with a helper, who launched the plane at the sound of a horn. The counterclockwise (to the left) race lasts four minutes until the horn is sounded again. The pilot finishes the lap he's on, while the helper times the lap after the final horn.

Any lap that has a cut isn't counted. Three typical performances might be

H. Heinisch and his Jens Bartels design Bonzai. This was the fastest plane at the meet and won second place. Plans for the model are available from Jens for $10.

recorded as 16 laps, 1.62 seconds; 17 laps, 7.35 seconds; and 17 laps, 3.52 seconds. The 17 laps, 3.52 seconds is the winner, because that pilot had the most laps and was closer to finishing the last lap. The Menzelener Club had three planes race at a time, which made flying much easier. There weren't any midairs in the entire meet. Eighteen pilots registered and flew. Racing started at noon and three rounds were flown, which kept everyone busy till six, when awards and prizes were given out. The three top fliers received trophies, and every pilot drew a number out of a cup for a numbered prize and received a certificate for participation.

Michael Markus won first place with 18 laps, 13.0 seconds and 18 laps, 8.10 seconds as his two high times. R. Heinisch came in second with 17 laps, 0.91 seconds and 17 laps, 0.11 seconds. K. Buter was third with 18 laps, 2.83 seconds and 16 laps, 7.65 seconds. They flew about 55 to 60mph. Markus and Heinisch had different approaches for winning: Markus had a conventionally built balsa plane of his own design, the Race Mouse. The fuselage is a conventional, square cross section and the wings are sheet balsa. Markus used the 6V Speed 400 motor and seven 700mAh Sanyo AR cells. The plane weighs about 19 ounces, and it's controlled by a Graupner* C12 receiver. The speed controller is on/off with a BEC that was built according to an article in the November 1991 issue of *Modell* magazine. He also used a Graupner Speed 6.5x6.5 prop that was cut down to about a 5.5-inch-diameter. *Modell* magazine will publish this design in the near future, and the plans will be available from them. It's a fine flying plane, and it's obviously very competitive. It's capable of flying a very tight course, and that helped Markus win.

Heinisch few a Bonzai that's a Jens Bartels design. Jens is well known for his designs, which are fast, fast, fast! The Bonzai was the fastest plane on the course, but it flew a wider pattern than the Race Mouse. If it had been flown as close to the pylons as the Race Mouse was, it could very well have taken first place. The Bonsai is more high-tech than the Race Mouse; it has a fiberglass fuselage and carbon-fiber wings. It looks fast just sitting on the ground! The plans are available from Jens for $10 (a $10 bill is the easiest way to pay, so you don't have to worry about the exchange rate).

There were several other planes that were quite fast. The Mini Race Cat is a T-tail racer with a fiberglass fuselage and sheeted foam wings, 20-inch wingspan, 115-square-inch area and 18-ounce flying weight. The Mini Race Cat at Menzelen used a Schultze* S-10-15e speed controller with BEC. The Mini Race Cat is available from Kurt Maier, but unfortu-

These are fliers in the Menzelener Speed 400 race. It was a perfect day for racing. As they say in Germany, "Viel Spass!" (Have fun!)

nately I don't have his address. The Mini Maus (Mouse) is also a T-tail racer with a fiberglass fuselage and planked foam wings. It flew very well. It's available from Rippin Modellbautechnik*. Modelle has the plans for the 26-inch-span vee-tail design, the Pocket Racer, by M. Kortenbruck. It costs about $10 including postage (order no. 9762). The Schawap 400 is a 27-inch-span racer with a fiberglass fuselage and sheeted wings. It has very good performance, and it sells for DM 169 ($109) from Scharmann u. Walter*. Modellbau Georg Weber* sells an almost-ready-to-fly racer, the Flash, with fiberglass fuselage and sheeted foam wings for DM 169 also. It looks much like the Race Mouse.

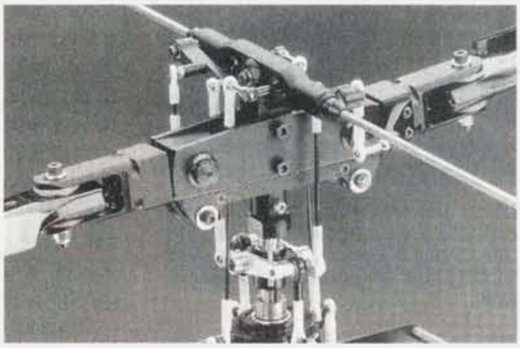
Here are some tips on what is "hot" in Speed 400 racing. The 6V and 7.2V versions of the Speed 400 motor are very popular. These are available from Hobby

(Continued on page 94)

ROTARY-WING ROUNDUP

NEW HELI PRODUCTS

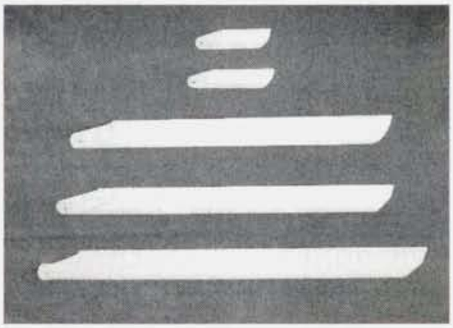
KSJ
818 Swing Rotorhead



The KSJ 818 Rotorhead is a breakthrough in head design. Each main rotorblade is free to pivot up and down, opposite each other, about 30 degrees on needle bearings. There's no dampening, so the blades go through this motion freely. The head allows the rotor disk to tilt several degrees without tilting the helicopter, thereby changing the disk angle (rather than the whole heli) for easier, more precise hovering corrections. The 818 also tracks smoothly, giving linear cyclic response without pitchiness.

Part no.—KSJ 161; **price**—$499.95.

Distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511.



ROTORMAX™
Composite Rotor Blades

Yellow Aircraft introduces a complete line of ultra-high-performance ROTORMAX™ composite blades. These blades have been tested extensively and will withstand the most aggressive hot-dog aerobatic maneuvers. They feature highly efficient tips and a fully symmetrical airfoil for fast, smooth and stable flight characteristics. They're reinforced with carbon-fiber, and a high-tech curing process provides maximum strength so ROTORMAX™ blades resist twisting and distortion during flight. All blades are balanced, lead-weighted in the leading edge for best CG and ready to bolt on.

Yellow Aircraft, 209 Massachusetts Ave., Lexington, MA 02173; (617) 674-2222; fax (617) 674-2188.

ROBBE MODEL SPORT
Moskito

The Moskito is a new Schluter 40/50-size R/C helicopter designed to satisfy both the novice and the expert. Its docile flying characteristics make it an ideal model for the beginner who still needs to master hovering; but in the hands of an expert and outfitted with a 50-size helicopter engine, it will give outstanding aerobatic performance. The Moskito is also quick and easy to build and maintain. Its features include a two-part, self-supporting composite frame with a radio mounting system; a new aerobatic main rotor-head design with 90 degree cyclic pitch linkage; a side mounted fan with starter cone for easy starting; autorotation clutch; one-piece blade holders with thrust bearings; tricycle and skid landing gear ; choice of standard or unique open cockpit with a pilot figure; molded, lightweight, plastic, horizontal and vertical stabilizers; and direct glow plug access. Specifications: rotor diameter—1,200mm (47.25 in.).

Kit no.—S2916; **price**—$469.95

Robbe Model Sport Inc., 180 Township Line Rd., Belle Mead, NJ 08502; (908) 359-2115.

7

The Kern River Blade Runners and Miniature Aircraft team up for a great event.

by ELAINE JACKSON

4th Annual Bakersfield

6

Heli Fun Fly

5

4

Clockwise from upper right corner: (1) Ten-year-old Jeff Taylor in the Novice Pad Hop event. (2) Greg Milosovetch with his X-cell Pro/Optima after a demo flight. (3) Robert Gorham with his TSK Blackstar after a demo flight. (4) Milton Del Rosario's Hirobo scale Vertol with a marine camouflage paint scheme. (5) Joerg Groessler's unique scale Sikorsky S-58. (6) Steve Harris's Vario Hughes 500 settles into a hover. (7) German National Champion Guenther Knipprath's custom Hughes 500 won the "Best of Show" award. (8) The "Team Kalt" (from left to right): Ken Marshall, Marty Kuhns and Gary Kurtzman. Background photo: The fun-fly pilots' line-up: look at all those rotors.

THE KERN RIVER Blade Runner's (KRBR) Fourth Annual Bakersfield Fun Fly cosponsored by Miniature Aircraft* had to be one of the most exciting helicopter events of the year. Helicopter pilots from all over the U.S. and three from Germany brought the total of registered pilots to 110, with well over 200 helicopters present. One of the main attractions that has quickly made this such a popular California helicopter event is the magnificent KRBR helicopter flying site—83 acres of low-cut grass. (The site includes 18 soccer fields.) This year, for the first time, the KRBR held a three-day event (April 30 through May 2). The raffle prizes were exceptional. A variety of manufacturers, distributors and hobby shops were very generous with their contributions; Miniature Aircraft, for example, donated an XL PRO Graphite X-cell helicopter.

The well-respected Ray Hostetler, author of *Ray's Complete Helicopter Manual*, held a 2-hour helicopter seminar on Saturday and Sunday.

EVENTS

The first day of the event was reserved for open flying and just having fun. On Saturday and Sunday, all the contest events were held at a secondary flying area. This reserved the main site for open flying and noontime flight demonstrations by factory representatives. The KRBR maintained strict frequency control between the two flying areas.

A-MAZE-ING

The popular Heli-Maze is a challenge to all helicopter pilots no matter what their skill level is. This event is divided into two stages. In the first stage, you must fly a straight course through a series of narrowing 3⁄16-inch-square balsa stick pylons. The second stage is a maze through which you must maneuver your helicopter without ever rising above the top of the pylons. If you cut a pylon, you're out. Your score is based on how many pylons you maneuver through before hitting one. Two courses were set up: one for the 30-, 40- and 50-size helicopters and one for the 60-size. Only two fliers completed it without hitting any pylons: Frank Taylor (30-size) and Kevin Scofield (60-size.)

PHOTOS BY LES JACKSON

DRAG RACING

Drag racing is a very popular fun-fly event, not only for contestants, but also for spectators. It's divided into two classes: .40ci engines and below, and .41ci and above. There's a timed qualification flight, then the double elimination finals. The six fastest qualifying pilots in each class participate in the finals. The 60-size class was won by Marc Fudderman, and the 30-size class, by Kenny Mooers. This was Kenny's lucky weekend; he not only placed second in the autorotation event, but he also won the XL Pro in the raffle. After the drags were officially over, there was an unofficial "Grudge Match" between the 60-size winner and the 30-size winner. Marc Fudderman won by barely a tail-boom length.

The autorotation event is also very popular. A new face on the helicopter scene is Dennis Galloway. He has been flying helicopters for a year, but this was his first event. In autorotation, he placed fifth out of 40 entries with some tough top contenders. The winner was Allen Yamauchi with his Miniature Aircraft XL Pro, equipped with the new twin tail-rotor system.

SCALE

The scale event had nine entries, judged by the registered pilots only. The helicopters were required to fly a designated course. One of my favorite ones entered was a classic 1971 vintage Schluter Tow Cobra. This was one of the original kits designed by Dieter Schluter. It was quite a project for owner Keith Griffin, who literally had to design and build his own mechanics for the 6-foot-long fuselage. A very impressive scale Kalt* Jet Ranger that belonged to John Trino was not able to enter the scale event because John is a KRBR club member. This 15-pound helicopter has a modified Kalt head, modified Kalt Gas Baron mechanics with a TSK* tail-rotor box and a Miniature Aircraft tube drive. Though John officially built the helicopter, Leonard Powell—owner of Nitro Alley (a local helicopter shop)—did the painting. The recipient of the "Best of Show" award, non-scale, was also determined by the registered pilots, who voted unanimously for the vibrant Hughes 500, built by the one-time German National Champion, Guenther Knipprath. The outstanding fuselage is manufactured by Guenther's company, Peka-Lufttechnik, in Aachen, Germany. In the U.S., the fuselage, the tail-rotor drive system and the paint scheme would be worth approximately $2,500. This doesn't include the special R&D modified Helm mechanics.

There were only a few crashes during the fun-fly events. The 32 crashes during the weekend were caused mainly by pilot error during open flying. In the best crash, the pilot literally lost his head. The bolt that holds the rotor head on the main shaft was sheared off during takeoff. It flew off while the helicopter stayed on the ground.

DEMOS

The first demo pilot to fly was Greg Milosovetch—representing Miniature Aircraft—who flew an X-cell Pro with the Miniature Aircraft Optima fuselage. This year, Greg gave a very smooth FAI-style performance compared with the hot-dog-style aerobatic flying he usually does. The "Team Kalt" was well represented with Ken Marshall, Marty Kuhns and Gary Kurtzman. Ken showed us that his 13-pound gas Baron Alpha was definitely an aerobatic ship. Marty likes to do his maneuvers with his Baron Alpha II very low to the ground. Tim Lampe, Helicopter Coordinator at Great Planes, was available to answer questions about the Concept* helicopter line. Tony Davis, a local sponsored flier, performed demo flights with the Concept 60 and the Concept 30 SR. Tony showed us the aerobatic and autorotation ability that has made the SR well-known.

This year, representing Century Helicopter Products* was Sean Berkheimer, flying their modified shuttle—the Ninja Pro. Shep "Flipper" Johnson from Texas did a demo with his X-cell. Performing consecutive flips, he showed us why they call him Flipper.

On Saturday, Robert Gorham flew his TSK Black Star powered by a Futaba* YS. He has been practicing for the team trials for the upcoming World Championships, so he was in top form. His Black Star has been clocked at 100mph with the Futaba YS engine.

This was the first time that I had the opportunity to watch the unbelievable Curtis

Winners

Novice Pad Hop
1. Tony Sara
2. Arthur Steinbach
3. Earl Russell

Drag Race (30-size)
1. Kevin Mooers
2. Rick Rubsha
3. Gary Kurtzman

Drag Race (60-size)
1. Marc Fudderman
2. Bryce Hatfield
3. Allen Yamauchi

Heli-Maze (30-size)
1. Frank Taylor
2. Tony Sara
3. Frank Eubank

Heli-Maze (60-size)
1. Kevin Scofield
2. Steve Harris
3. Kolby Harsh

Autorotation
1. Allen Yamauchi
2. Kenny Mooers
3. Bart Nelson

Scale
1. Mike Lerner—Bell 47G (Hirobo*)
2. Brian Smith—Heli USA (Concept 30)
3. Sean Berkheimer—Sea King (Century Helicopter Products)

Heli Count at Bakersfield

X-cell	40
Kalt	20
Kyosho	17
Schluter	8
TSK	16
Shuttle	14
GMP*	7
Vario	3

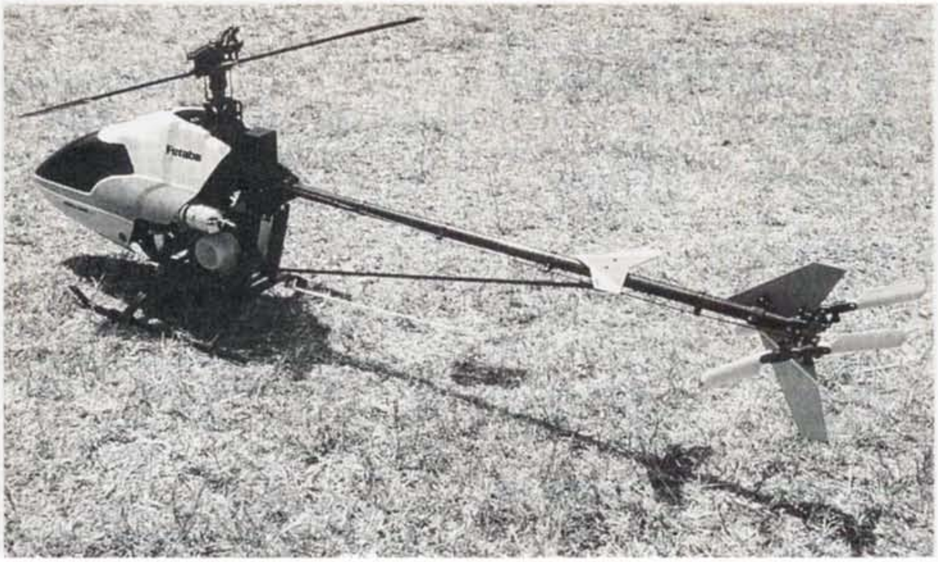
New Blood

When I first met Vincent Trino in May '92 at the Bakersfield Fun Fly, he was just learning to hover. At the West Coast Helicopter Championships in Bakersfield the following fall, the 13 year old had the chance to meet the famous world-class flier, Curtis Youngblood. Despite the big age difference, the two became immediate friends. They kept in touch during the following months by phone.

Curtis Youngblood (right) and 13-year-old Vincent Trino made quite a team and became friends because of R/C helicopters.

In March, Vince had an opportunity that most of us only dream of. Curtis invited him for a visit during his spring break from college. For more than a week, they flew all day and talked about helicopters. Together, they used 11 gallons of fuel. When Vince left for Texas, he was doing some forward flight. He came back from "Camp Curtis"—as envious KRBR members called it—an accomplished pilot.

Vince's father, John, insists that his son maintain a 3.0 average in school, or else no helicopter. When Vince went out to fly, his dad put his hand on his shoulder and said, "Be careful, son, watch the wind, fly conservatively." Vince smiled, and told me he always says that. I was amazed as I watched him fly. He still flies every weekend with his dad. He assured me that, though he treasures his unique friendship with Curtis, nothing is more important to him then flying with his dad.



Allen Yamamuchi's twin tail rotor X-cell Pro won the autorotation competition.

Youngblood fly his X-cell. This very likeable young man can do incredible things with an R/C helicopter. Most of his maneuvers are almost indescribable. In his famous "death spin," he takes the helicopter up very high, does a knife-edge, gives it full up-elevator and tumbles it all the way down. It's awesome to watch him fly around the field doing backward rolls, or his pirouetting loops and rolling autos.

On Sunday, Guenther Knipprath and his friend Raimund Zimmerman (both from Germany) did a flying duet with their identical Hughes 500s. They displayed the European style of flying with their hot-dog, scale-like maneuvers, including leapfrogging. Guenther likes to bring his helicopter in fast and, before he levels out for landing, he stops it in front of him with the ship at a 90-degree angle with the tail, inches from the ground. Their flying was exciting to watch, and their antics on the ground were original. Without ever lifting into a hover, they literally chased each other around the field, like two R/C cars. Then Guenther did his "duck walk" by walking his helicopter one skid at a time. At the end of their performance, Guenther and Raimund simultaneously bowed their helicopters by balancing them on the tips of the front skids while in a hover.

EXHIBITS

At the popular Miniature Aircraft display, Greg Milosovetch was available with its newest products. On display was the new carbon-graphite side frames for the standard X-cell 30, 40, 50 and 60. The Flybar Alignment Kit, Universal Swashplate Lock and the Koll Rotor Pro Blade Balancer are only a few of the new products from Miniature.

This summer, Miniature will be introducing its new XL Pro Gas Helicopter Kit powered by the popular Zenoah* G-23.

The most revolutionary product on display at this event was the SSG-1 electronic gyro produced by Sundance Model Products Inc.* This completely solid-state gyro contains no motors, no springs, and no weights or moving parts to wear out!

At the TSK booth, Clint Williams had the high-quality, precision-engineered TSK line of helicopters on display. The new Black Star GS 11 is their 11-pound gas helicopter. Clint told me that all the TSK helicopters can be adapted to use 4-stroke engines.

X-cell Pro Heli on display for the raffle prize.

The Ninja Pro Side Frame Conversion Kit for the Shuttle ZX was exhibited at the Century Helicopter Products booth. This was the modified shuttle that Sean Berkheimer used in his aerobatic demo flight.

Tony Sara of Rybett Controls* displayed the popular line of aftermarket X-cell performance parts produced by Bergen Machine* and Bennett Products*. Schluter fliers will be happy to learn that Bennett is producing composite side frames and accessories for Schluter helicopters.

At the popular Vortex* booth was a wide variety of helicopter accessories for sale. The new product that generated the most excitement here was a precision-designed, aluminum X-cell head block manufactured by T&T Engineering*. It was almost too beautiful to put on a helicopter.

A PERSONAL THRILL

The biggest thrill for me came during the last hour of the event. All weekend long our shade canopy was set up next to the German's canopy. We became friendly with Raimund Zimmerman who writes for *Rotor*, the German helicopter magazine. Against my protest, my husband asked Raimund if I could fly his beautiful Hughes 500. Raimund was very enthusiastic. I knew if I refused, I would live to regret it.

Raimund uses a JR* radio, though it's much larger than ours. In Germany, they also fly mode two, as we do, though their collective/throttle stick is set up the opposite of ours. They pull the collective stick down to go up. Fortunately, Raimund could reprogram the radio for me. I was conservative and only hovered. At first, I had a little difficulty because the rotor head rotated in the opposite direction of our machines. In Germany, most helicopter pilots fly with a full fuselage. Generally, only novices fly "pod and boom," which is so popular in the U.S. I was extremely nervous; I knew this helicopter was worth close to $5,000. It was definitely a thrill I will never forget.

The Kern River Blade Runners thank Miniature Aircraft, Airtronics, Futaba, Helicopter World, Powermaster Fuel, Great Planes Distributors, Horizon Hobby Distributors, Rave, Performance Products, Tradewinds Int'l, Silas Kwok Helicopters, PTI, Bergen Machine, Nitro Alley, Floriana's, Pure Tech Designs, Vortex R/C. Helicopters, Stan & Olie's Hobby, Horizon.

Here are the addresses of companies mentioned in this article:
Miniature Aircraft USA, *3743 Silver Star Rd., Orlando, FL 32808.*
Kalt; *distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821.*
TSK/USA Ent., *2973 Harbor Blvd., #340, Costa Mesa, CA 92626.*
Century Helicopter Products, *521 Sinclair Frontage Rd., Milpitas, CA 95035.*
Concept; *distributed by Kyosho/Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
Zenoah; *distributed by ISC Int'l., P.O. Box 40116, Indianapolis, IN 46240.*
Sundance Model Products, *2427 W. Adrian St., Newbury Park, CA 91320.*
Rybett Controls, *West Coast Distributors for D.C. Nelson, Enterprise, 3584 S. West Temple, Salt Lake City, UT 84115.*
Bergen/Bennett, *10020 Canoga Ave., Chatsworth, CA 91311.*
Vortex R/C Helicopters, *1374 Logan Ave. #A, Costa Mesa, CA 92626.*
T&T Engineering; *available through Vortex R/C Helicopters.*
JR Remote Control; *distributed by Horizon Hobby Distributors.*
Hirobo; *distributed by Altech Marketing, P.O. Box 391, Edison, NJ 08818-0391.*
GMP; *distributed by Tech Specialties, 218 Vernon Rd., Greenville, PA 16125.*

GLUE BASICS

A Sticky Subject

by GEORGE WILSON

The author's workbench with more than 15 glues at his disposal.

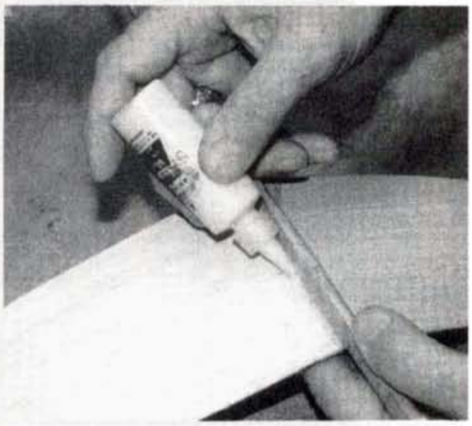
Photos by E. J. McCarty

Editor's note: George Wilson has been building model airplanes for 64 years; he has published many construction and how-to articles, and he remains an active model designer, builder and flier. While participating in the R/C Flyers Net (amateur radio operators who meet daily from 6 a.m. to 7 a.m. Eastern Time on 3933KHz), George was struck by the number of newcomers to modeling who were not well-informed about glues (particularly those that were in wide use prior to the arrival of CA). This overview is the result. For more information on the R/C Flyers Net, contact Net-control operator Fred Lomax, 204 S. Claiborne St., Goldsboro, NC 27530.

A WELL-EQUIPPED model workbench should have several types of adhesives/glues on it. There is no such thing as an all-purpose glue, although some ads give you the impression that their product will work on everything. The following are some comments on glues based on my experience.

ALIPHATIC RESIN

The glue I use the most is aliphatic resin. It's sold under names such as Titebond, Sig-bond and Carpenters' Glue. Aliphatic resin gets tacky quickly, and it sets up in about half an hour. (An unstressed assembly can be moved in 10 to 15 minutes.) Several hours are required for a good cure. This glue is water soluble and totally fuel-proof. If you're using aliphatic glue to build a seaplane, coat it with diluted dope or Hobby Poxy* II—a good practice no matter what glue you use. The excess aliphatic that oozes out of a joint can be wiped away with a damp cloth.



A small squeeze bottle is essential for holding aliphatic resin glues. Here, a glider wing joint is being reinforced.

Unlike white glue, e.g., Elmer's Glue, aliphatic resin glue can be sanded easily, especially if you wipe the excess away first. White glues are rubbery when dry, they're tough to sand, and they aren't recommended for model aircraft construction. However, when white glue or aliphatic glue is diluted two to one with water, both can be used to attach tissue paper, e.g., silkspan or Japanese, to balsa structures. (While I'm on this subject, Dennison's Glue Stic is great for attaching light tissue to the framework of rubber-powered models.)

EPOXIES

In my shop, I use epoxies most often as coatings in preparation for finishing and to attach materials such as fiberglass. Yes, they make strong joints but, for me, the nuisance of mixing them and having on hand the epoxy with the proper cure time (5 minutes, 10 minutes or one hour) limits their use to covering and coating, e.g., fuel-proofing engine compartments. Watch for allergic reactions if you use epoxies.

CYANOACRYLATE

Cyanoacrylate glues (CA) have their place in spite of their allergenic properties. The irritant/allergen is acetic acid, which produces a temporary effect. (See "Building Model Airplanes," in the November '91 issue of *Model Airplane News*). For many of us, they can be powerful irritants to the eyes, the sinuses and the lungs. I have a fan that blows across my bench when I'm working with CA. I've tried masks that filter out chemical fumes; they work, but they're awkward. I find them impractical unless I use CA for prolonged periods. *[Editor's note: allergic reactions to epoxy and CA vary widely. Some people readily develop an allergic reaction, and others seem to have no problem after years of using these substances. Don't let these glues come in contact with your skin, and don't breathe in the fumes.]*

CA is the most useful when I want to jig and/or align pieces. Baking soda (non-allergenic) or an accelerator (most often

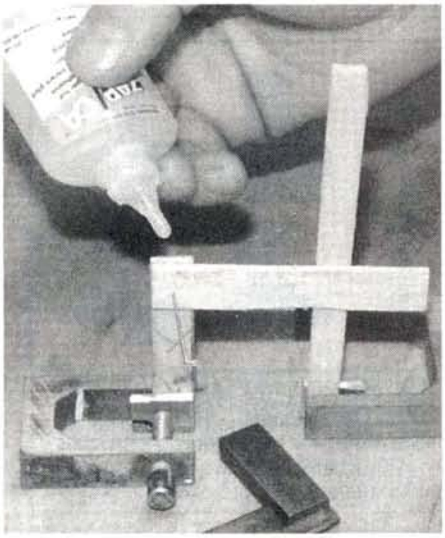
allergenic) helps to set up pieces quickly. More CA or another type of glue can be added to strengthen the joint. You can sprinkle the baking soda on the wet joint or apply CA to a fillet of baking soda.

Water on one or both sides of the joint is also an effective accelerator. CA can also be used to join plastics such as Lucite. The joint is almost invisible when it's done correctly. If you've applied CA where you don't want it, e.g., on your new sunglasses, a good debonder or CA solvent can make all the difference. One of the best, in my opinion, is Golden West* Super Solvent.

The more expensive, odorless CA is on my to-be-tried list but, for now, because I only use small amounts, I'll stick with the less expensive kind and keep on using my fan. *[Editor's note: we can vouch for the benefits of the odorless CAs.]*

R/C 56

Wilhold's R/C 56 glue, available at nearly any hobby shop, works well on plastic to plastic and on plastic to balsa joints. It dries clear, although it's white and water soluble before it



CA (instant glue) is being used to tack a jigged structure together. CA can irritate eyes, lungs and sinuses. (See text.) The odorless variety may solve this problem.

cures. If you apply too much, wipe off the excess with a damp cloth. Don't fret about the film that may surround the wiped area; it will wipe off easily with a damp cloth when it's partially dry.

Use R/C 56 to glue plastic parts (like windows) to doped, polyurethane, etc. finishes. The manufacturer claims it adheres well to most plastic surfaces. It's odorless and appears to me to be non-allergenic. Wilhold doesn't advertise R/C 56 for general usage; however, fellow modeler Ed McCarty has found that it works well for installing pin-type hinges. The plastic-to-balsa joint is very strong, and the excess comes off with a damp cloth.

PLASTIC-BASED GLUES

Plastic-based glues such as butyrate (Ambroid, Sigment) and nitrate (Duco, Ever Fast) were, at one time, the only glues used to build model airplanes. They still work well, but they dry out over the years, and this makes the structure unairworthy. The glue lasts longer if you pre-coat the joints with glue and let them dry before making the joint.

SOLVENTS AND CONTACT CEMENT

Polystyrene glues (or solvents used as glues) can be used to build and repair polystyrene model airplanes and other polystyrene devices. Testor, among others, makes a good one.

Contact cements are essentially for laminating sheet material, e.g., wood to wood, wood to metal or plastic, or wood to foam. Many of these cements will destroy foam, so make sure the cement you're using is safe. Goodyear's Pliobond makes a very strong joint when it's used as a contact cement.

3M's Super 77 is a spray contact cement that works well for bonding balsa sheet to foam. Note, however, that dark-colored plastic covering exposed to the sun can become loose. *Caution!*—The fumes from spray glues are usually toxic, so wear an air filter (canister) mask.

HEAT-SENSITIVE GLUES

Heat-sensitive glues for models were first used as coatings on the backs of heat-shrink covering; later, they were used to attach coverings that were not pre-coated with adhesive. Micafilm (my favorite covering), Sig's Koverall, silk, silkspan and other uncoated or coated materials can be attached using these relatively low-temperature materials. The liquid glues, e.g., Sig's* Stix-It and Coverite's* Balsarite allow you to position the covering exactly where you want it. These glues are fuelproof, and they can be diluted with butyrate thinner. They work best, however, when they're relatively thick.

R/C-56 was used to attach the windows of this Feris JN-1. It's goes on white, but it dries clear and forms a strong bond. A fine addition to the glue family.

Like R/C 56, the aliphatic resin glues can also be used in their heat-sensitive mode to join sheet materials. In this case, the glue actually polymerizes, i.e., it makes a molecular bond and is no longer water soluble. This approach can be quite helpful when you're installing windows. The joint is permanent. Coat both surfaces with glue, and let them dry. Then position them and apply heat with a sealing iron. Move the iron slowly to let the heat penetrate.

FLEXIBLE SUPER-GLUES

These glues can be used with a wide variety of materials, and they remain partially flexible after they set. Use them to attach canopies to a plastic covering such as MonoKote, mount lead weights to a firewall, mount servos to an ARF plastic fuselage, or join batteries in a battery pack. The two brands I'm familiar with are Pacer's Zap a-Dap-a Goo* and PFM*. The strength of the bond of these glues is outstanding.

The products mentioned in this article are not meant to be exclusive endorsements. They are meant to be representative of the glues that I have found useful. There are many brands of glues, and most of them are top-notch. Most of the products mentioned are available at your hobby shop. Others can be found in good hardware stores. I hope this information has been useful.

**Here are the addresses of the companies mentioned in this article:*
HobbyPoxy Products; *Div. of Pettit Paint Co. Inc., 36 Pine St. Rockaway, NJ 07866.*
Golden West, *P.O. Box 6400, Woodland Hills, CA 91365.*
Sig Mfg. Co., *401 S. Front St., Montezuma, IA 50171.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*
Zap a-Dap-a Goo; *manufactured by Pacer Technology and Research, 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730; distributed by Frank Tiano Enterprises, 15300 Estancia Ln., W. Palm Beach, FL 33414; Robart Mfg., P.O. Box 1247, St. Charles, IL 60174; House of Balsa, Inc., 10101 Yucca Rd., Adelanto, CA 92301.*
PFM; *distributed by Hobby Lobby International, 5614 Franklin Pike Dr., Brentwood, TN 37027.*

SPORTY SCALE TECHNIQUES

FRANK TIANO

AUTHENTIC COVERING TECHNIQUES

I NEVER WOULD have guessed how much correspondence my article of a few months ago on covering materials would have produced. It just goes to show me that many techniques that more experienced modelers take for granted are sometimes loosely understood and sometimes downright intimidating to fellas who are just starting. With this in mind, let's take a closer look at what types of covering can be used on a sport or competition scale model and how they are applied.

Brian O'Meara chose a semi-aluminum finish for his Barton Mustang. Some of it is tape, and the balance is special aluminum automobile paint. Betcha can't tell where one stops and the other begins.

ANY SCALE USES FOR MONOKOTE?

The most common of all covering materials for sport scale models is Mylar, and probably the most well-

Jerry Caudle's Top-Gun-winning T-33 completely covered in Coverite's Presto aluminum material. He lightly rubbed the areas to be painted with steel wool. There were no adhesion problems; this is as much like aluminum as you're going to get without using real metal.

known of these shrinkable plastic films is Top Flite's* MonoKote. I know of only one full-size aircraft that was actually covered in a plastic film: it was a J-3 Cub from the early '70s that some creative guys covered in iron-on Mylar. I honestly must say that while MonoKote can be used on any sport model, it has absolutely no use on a competition model—except in two places: it makes a terrific parting or release paper when you use a resin and filler slurry to form a perfect cowl or hatch; and clear MonoKote can be primed and painted to look like a metal surface. Paint doesn't adhere very well to MonoKote, so we only use it in areas that *won't* be masked off. As far as how you use the stuff, every roll comes with explicit directions. The only tool you'll need is a sealing iron that's made for applying Mylar shrink film.

METHODS OLD AND NEW

On frame-and-fabric aircraft, some of the older modelers may still use the silk-and-dope covering method. For me, there are just too many neat and user-friendly substitutes that look, feel and act just like the fabric covering that's used on full-scale aircraft. Although many companies, e.g., Sig* and Goldberg*, offer these fabrics, Super Shrink Coverite* seems to be the most popular. Once again, use an iron to attach the covering to the model's framework. Modelers like Coverite because it easily covers compound, curved wingtips, and it has a realistic weave. I must say, however, that Goldberg and Sig coverings are pretty easy to work with also. The secret to making these fabric coverings look good and remain user-friendly is simple: keep the weave spanwise, and *always* read the directions! We've talked about this before, but a letter from a friend in Miami really tells it all. Lyman Slack is a retired Pan American 747 driver, a fabulous model builder and a great competitor. Here's his letter:

In your "Sporty Scale" article in the July '93 issue you talked about preparing fabric coverings. I agree with fol-

Charlie Chambers has become the authority on covewith aluminum tape. Here is his fabulous Mustang—now an impeccable Bearcat from Jerry Bates plans. Different burnishing tools create different shades of aluminum. Some areas are painted (where the metal simply wouldn't conform).

lowing manufacturer's directions; they're most useful when all else fails!

Let's expand this a bit. If you are fortunate enough to be building a scale model of a full-size, fabric-covered aircraft that still is airworthy and you know the owner of the plane, it's for sure you have a friend! Most likely, he'll not only tell you what finishing procedures he used, but he can also supply you with color data.

I was fortunate during the building of my last two scale projects in that the full-scale versions are still flying! The first was a 1/4-scale Decathlon; the second was my JN-4-C Curtiss Canuck (Canadian Jenny).

Both of these aircraft had been refinished within the five-year time frame prior to my documentation, and they've been in hangars ever since. They were only exposed to the sun during the flight time.

Both of these aircraft had been finished with Randolph aircraft dopes. Since our Super Coverite is basically the same as the aircraft fabric Ceconite, the same technique and dopes can be used!*

I talked to the folks at Randolph, and the technique is as follows: after a thorough cleaning, brush on one or two coats of very thin, clear nitrate dope; this "bites" into the weave of the cloth. Spray on as many coats of clear butyrate dope as are necessary; only sand every few coats. This really goes fast. (We've forgotten how easy it is to work with aircraft dopes, with the exception of working in our Florida humidity, which causes blushing.) This can best be prevented by not spraying during a thunderstorm; just wait for a "dry" day. Even then, use a retarder as a substitute for up to 20 percent of the thinner. By the way, stick to the non-tautening, clear dopes.

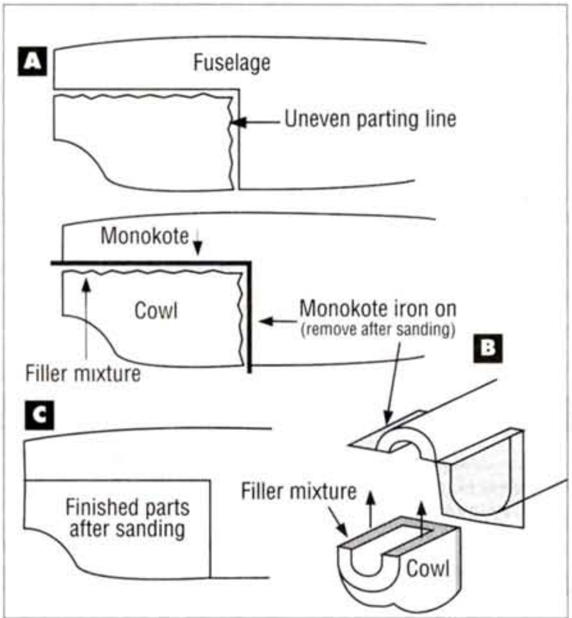
Kent Nogy used a combination of materials on his F-86—primarily chrome MonoKote and Presto. The full-size aircraft had a buffed finish, so this is definitely realistic.

Colonel Art Johnson favors the litho-plate or printers-plate aluminum along with some aluminum tape. He's been using them for years. Simulate rivets with a sewing wheel or the Chambers' method—a sharpened brass tube!

PERFECTLY MATCHED

I mentioned earlier that I like to use MonoKote as a release paper when I make parts that mate perfectly to each other. The technique is shown here and is self-explanatory. The reason I use MonoKote, instead of EconoKote, is that the Mylar will withstand the heat generated by the curing resin, and it won't shrink up or burn through. Let's say that we have a removable cowl and we'd like to camouflage its separation line. (In other words, we don't want anyone to notice that there's a parting line!)

You must make the fuselage as neat and perfect a mating surface as you possibly can. Apply a piece of MonoKote to the surface, leaving some excess material. Smear a thick mixture of polyester resin and lightweight filler on the sides of the cowl that will come in contact with the fuselage. Fasten the cowl in place, and let the mixture ooze out of the cavity you're trying to fill. Set the fuselage aside so the resin can cure. After 30 minutes or so, lightly carve or sand the excess mixture away from the parting line. Unfasten the cowl and tap it firmly to release it from the fuselage. Remove the MonoKote and reinstall the cowl. Now you have a perfect fit. Yes, perfect! This method can be used anytime that two removable parts must fit together perfectly.

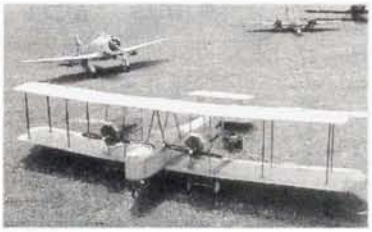


After you're happy with the clear base, everything gets a couple of coats of the UV protectant, Rand-O-Fill. This thin, silver, base coat protects the fabric. No, dummy, we don't really need it to protect our models, but it's necessary to ensure that the color butyrate you've selected matches the full-size airplane!

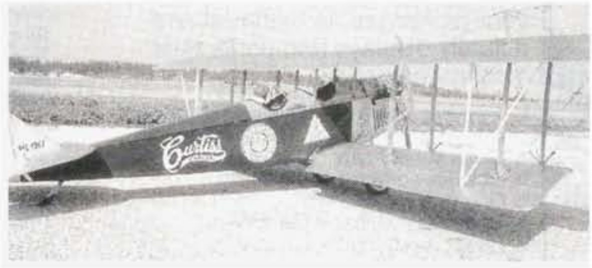
Use low-tack masking tape, and you'll have no problems with your trim. Apply decals, paint and any other livery with thin acrylic lacquer or sign-painter's enamel.

These aircraft dopes are available from the Alexander Aeroplane Company, Griffin, GA. Call (800) 831-2949 for a catalogue; you can also call Randolph, (201) 438-3700 for a product application booklet as well as color charts and color cross-reference lists. (i.e., Randolph's Bahama Blue is the same as Piper Bahama Blue, Bellanca Alexandria Blue, Grumman Patriot Blue and Maule Rocket Blue.) Randolph also has historical cross-references; i.e., my Canuck's base color was called "Travel Air Blue" way back when. The same color was renamed "Consolidated Blue" during the big war, and now it's called "Miami Blue."

Anyhow, Frank, this is what works for me; just remember: nitrate under butyrate—never over!



The Vickers Vimy team entry of David Boddington and Gerry Rathband is all Coverite and clear dope. After doping, a dark gray wash made of thinned dope was sprayed over the entire aircraft for this realistic effect.



Lyman Slack's beautiful Jenny covered in Super Coverite and painted with authentic Randolph dope . See text for available colors along with where and how to purchase real aircraft dope.

AUTHENTIC METAL LOOK

One of the most difficult finishes to duplicate is one that looks like real metal. To achieve this look, you can use several forms of aluminum tape, or sheets of aluminum such as those offered by Foley Mfg.* Or, you may elect to use one of the chrome or aluminum films that are offered by Coverite or MonoKote. Coverite has a product called "Presto" that's about as close to a buffed, shiny aluminum finish as you can get. Top Flite's chrome MonoKote is just as shiny, but it requires a bit more fussing to get it wrinkle-free. Both are applied with a heat-sealing tool, and both can be painted. You can also use thin pieces of real metal that come in rolls or sheets. Some modelers use printer's litho-plate aluminum and apply it with contact cement. Whichever metal you choose to work with, be warned: it's a real chore.

Sometimes you'll need to try several times before you get one panel right. Sometimes the very last 1/2 inch of that panel will develop a wrinkle, and you'll be forced to remove the entire panel and start all over again. The overall effect when it's finished, however, is excellent. Most rolls of metal tape have peel-away sticky backs and don't require any contact cement. Usually, you have one shot at getting the metal down in the right spot. If you err, the glue loses most of its stickiness, and if you try to lay the same panel down again in a different place it may not adhere well. Taping the panel in place and *then* removing the paper backing seems to work best. In all cases, to form a panel, slowly and carefully burnish the metal with large and small craft sticks and squeegees. All the seams are butt joints, and they rarely overlap. Oh yes, when you use real metal, cover the entire model with fiberglass so that the metal can adhere to a hard skin. Do *not* attempt to put metal on bare balsa.

If you like the look of a certain finish, go ahead and try to duplicate it on some scrap pieces of material. No foolin'—take a piece of 1/4-inch balsa and try out whichever method you like. You'll be amazed at the techniques you'll develop for a given material. And don't get disappointed and give up after only a couple tries. Stay with it; I promise you'll get the knack. I tried several times to cover an airplane with aluminum and gave up, but a friend worked with me until we developed a technique. Now I'm not at all intimidated. Time consuming?—you betcha, but scary, no!

COMING ATTRACTIONS

Next time we'll take an in-depth look at some of the more unusual aircraft that were seen at Top Gun and of a real neat drive system that I think is suitable for the new, large-scale racing events. Also, I'll have some neat new tricks for getting airplane stuff into the house, because you *know* your wives don't believe that this stuff costs just pennies anymore. Until next time, your six is clear.

**Here are the addresses of the companies mentioned in this article:*
Top Flite; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*
Sig Mfg. Co., *401 S. Front St., Montezuma, IA 50171.*
Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*
Randolph Products; *distributed by ABC Hobby Supplies, P.O. Box 2391, Clarkesville, IN 47131.*
Foley Mfg., *115 W. 9th St., Roanoke Rapids, NC 27870.*

AIRWAVES

(Continued from page 64)

prone to rocking.

Keep up the good work.

MARK D. SHEEHY
Royal Oak, MI

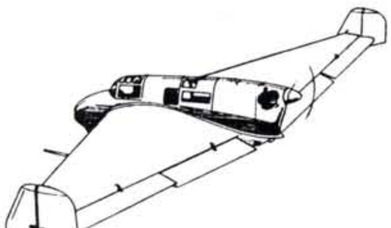
Thanks, Mark, for the tip on the hideaway workbench that uses a Black and Decker Work-Mate! TA

ELECTRICS

(Continued from page 77)

Lobby*. The props are either unmodified 6x4 or the Graupner Speed 6.5x6.5 props that have been cut to a 5.5-inch-diameter and sanded to a swept-back leading edge. The speed controllers can be either on/off or high rate; all the competitors used ones with a BEC to eliminate the receiver battery. The receiver should be light. To save weight, some pilots use conventional receivers in shrink-wrap instead of a regular case. The batteries are Sanyo AR cells that have a red jacket. The sizes that are used range from 450 to 700mAh. So there you are; let's go race! If you wish to write to me, I have a new address: Mitch Poling, 601 Med Sqn PSC 10, Box 1908, APO AE 09130. You can use the usual 29-cent, first-class postage. *[Editor's note: certain addresses were not available as we went to press, but they will be included in the next issue at the beginning of "Airwaves."]*

**Here are the addresses that are pertinent to this article:*
Aichstetten, *Germany VTH; Postfach 1128; 7570 Baden-Baden, Germany.*
Jamara, *Inh. Erich Natterer, Gewergebiet 5, D-7974, Germany.*
Interelectric AG, *Maxon motor GmbH, Wardeinstrasse 3; 8000 Muchen 82, Germany.*
E. Schoeberl, *Wilhelm-Albrecht Strasse 2; 8540 Schwabach; Germany.*
SR Batteries Inc., *Box 287, Bellport, NY 11713.*
Astro Flight Inc., *13311 Beach Ave., Marina Del Rey, CA 90292.*
Cox Hobbies, *350 W. Rincon St., Corana, CA 91720.*
Graupner; *distributed by Hobby Lobby Int'l.* **Schultze Elektronik GmbH,** *Prenzlauerweg 6, 6108 Weiterstadt; Germany.*
Rippin Modellbautechnik, *5860 Iserlohn, Weststrasse 39, Germany.*
Scharmann u. Walter, *Balthasar-Neumann Strasse 19, 6056 Heusenstamm, Germany.*
Modellbau Georg Weber, *Am Dorngraben 10, 8751 Haibach, Germany.*
Hobby Lobby Int'l, *5614 Franklin Pike Cir., Brentwood, TN 37027.*



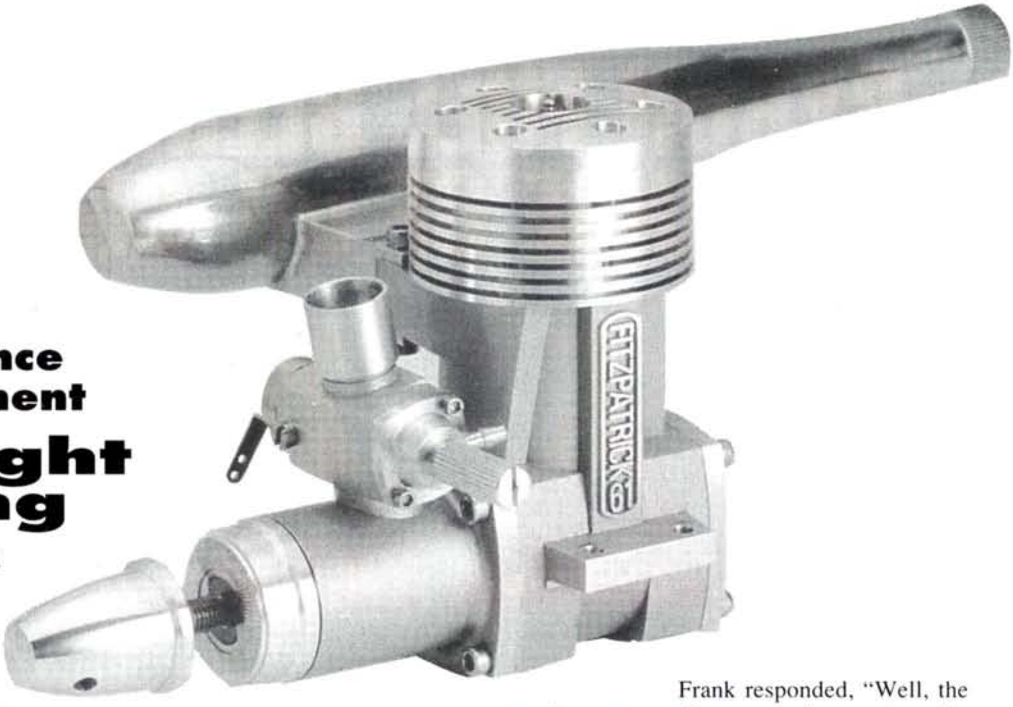
ENGINE REVIEW

FITZPATRICK .61

Real Performance Measurement

In-Flight Testing

by DAVE GIERKE



THE FIRST THING I noticed when the Fitzpatrick* .61 arrived was the size of its box; it was a giant thing: 13 inches long, 7½ inches wide and 5 inches high. (Hmmm...I could store six pylon racing engines in there...) Just then, my neighbor Frank Vassallo ambled into the RPM workshop.

"What have you got there, Dave—a new toolbox? I saw the mailman, and I thought it might be a new engine for testing...but the box is too big."

"It's an engine, Frank," I replied. "It's the Fitzpatrick .61."

"Isn't that muffler a little small? I wonder if it does a good job of silencing?"

"We'll soon see, Frank. I was just looking at the cylinder head. It sure doesn't have many fins—just a few machine cuts around the glow plug...must be OK, though; the instructions say it's a 'thermal dwell heat-sink head'...coolest running engine around."

"Maybe," said Frank. "But I'm still looking at this muffler. Do you know what? There aren't any baffles, chambers, resonator tubes or *anything* in here."

"Well, maybe they know something that we don't, Frank. We'll just have to wait for the dB sound meter test."

"Wow!" exclaimed Frank. "Look at this—a one-piece carburetor and crankshaft housing. I hope you don't hook the ailerons up backward again, as you did when you demolished the Airtrax* with the Webra*!"

"You never forget, do you, Frank? That dumb mistake will never happen again. But say it did. What's the big deal?"

"Well," he continued, "with this engine, you would have to replace the whole front end—carburetor and front housing. With the Webra, you just replaced the housing, right?"

"You're right there; the carburetor wasn't hurt. I see your point, but this design is supposed to prevent air leaks from occurring."

We both saw the ¼-inch-diameter threaded prop shaft at the same time. Frank asked, "How are we gonna use those high-pitch APC props? They've got 5⁄16-inch holes in the hub. I guess I'll have to make some brass bushings."

I looked at the instructions. "They say this is a removable stud. That's why it's small."

Frank responded, "Well, the next time you crash, you can just replace the threaded section and not the whole crank."

"What an optimist you are, Frank."

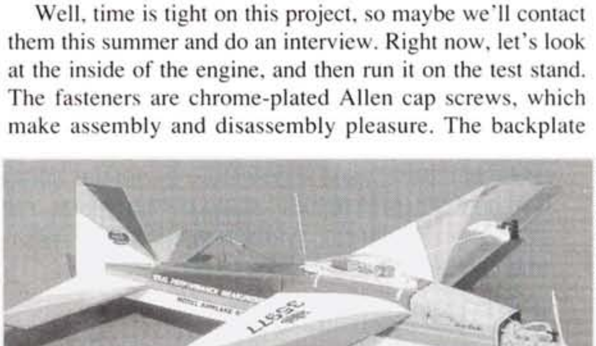
As we looked over the engine, I pointed out the beautiful casting and machine work. "The engine certainly looks nice, doesn't it? According to these instructions, the Fitzpatrick brothers claim this it the 'highest-quality engine in the world.' They also say that it's the 'most powerful .61 on the sport market' and, simply, the 'best sport engine.' I guess that's why they call it the *Super* engine, Frank. Look at those lost wax process (investment) castings for the crankcase and front housing—carburetor—nice, huh?"

"They should be, Dave; the paper here says that 'super precision' is performed by 'computer numerical control machining centers' [CNC]."

"Yes, I understand the engine is manufactured in Fort Erie, Ontario, Canada. That's not too far from us, Frank. Do you want to take a drive up and see their operation?"

"Only if we can bring back some good Canadian ale, Dave."

Well, time is tight on this project, so maybe we'll contact them this summer and do an interview. Right now, let's look at the inside of the engine, and then run it on the test stand. The fasteners are chrome-plated Allen cap screws, which make assembly and disassembly pleasure. The backplate



PHOTOS BY DAVE GIERKE

The Airtrax 60 with the Fitzpatrick .61. Notice the new whip antenna for the telemetering transmitter.

and front housing are gasketed with copper shims—a nice touch. The crankshaft counterbalance assembly is of the packed, 360-degree variety. The connecting rod is made of aluminum bar stock, bushed at both ends with bronze inserts. The ABC piston and cylinder arrangement follows state-of-the-art porting procedures of Schnuerle design (seven ports, total). The bar-stock head has a typical squish-band configuration with a very high squish-band angle. The crankshaft is supported by twin ball bearings, sporting phenolic cages.

"The paperwork says that the engine is 'selectively custom hand-fit and assembled'," Frank said. "What does that mean to you, Dave?"

"From my experience, the most important fit for any ABC engine is the piston to cylinder. They probably shuffle these parts until optimum pairs are matched. Heads are another critical area of concern, a light push fit into the upper cylinder is desirable. We can't afford any loose fits here; the head keeps the cylinder round when heating and expansion happen. What does concern me here is the fit between the head button and the sleeve; it's too loose. This should be a snug fit. There are many other areas where the pieces have to fit, but that's the case with any engine of this type. Someone has to hand-assemble it; I don't think robots are doing it yet."

Frank replied, "Well...maybe in Japan."

My ultrasonic cleaning process revealed a few small aluminum chips in the filtered solvent. Re-assembly using a bit of Marvel Mystery Oil was uneventful, and we proceeded to mount the engine on our Sheldon* all-aluminum test stand. After seeing the beautiful, heavy-duty stand, Frank remarked, "I'm glad you followed the safety instructions that the Fitzpatrick brothers provided, Dave."

"Oh? What do you mean?" I asked, suspecting the other shoe was about to drop.

"Yeah, the part that reads, 'Do not clamp the engine in a vise.' "

"Thanks a lot, buddy. I never did that—even as a kid."

"That's not what your mother said."

"Come on, Frank; help me carry the test stand out to the driveway."

BREAK-IN

"Why are we bothering to do this, Dave? Didn't you read the instructions? It says: 'set throttle 1/4 to 1/3 open; open main needle valve 2½ turns for first start. Open to full throttle, then lean [close] to *slightly* rich 2-cycle for the first 30 minutes of *flying*'."

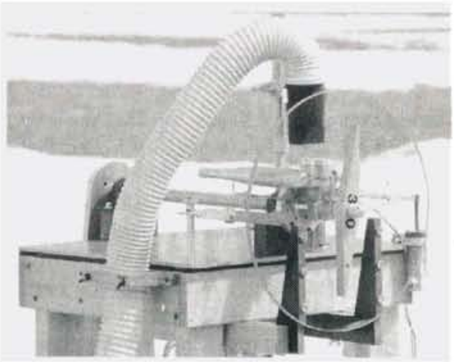
"Well Frank," I replied, "you know the unwritten rule here at RPM: no engine will be flown before its time. As far as I'm concerned, all engines need to go through break-in on the bench. How else can you control what's going on—quickly?"

"Don't get steamed up, Dave. I happen to agree with you, but you're still not following the instructions."

"Hand me the starter, Frank."

This was the first nice day to be outside with an engine—at the end of March, in Buffalo. Brrrrrr—46 degrees isn't bad for us, though. The wet bulb registered 44 degrees Fahrenheit, and the barometric pressure was 29.32 inches of mercury—atmospherically, a good engine performance day. After Frank had read the rest of the instructions to me, I decided to use my standard fuel mix. They recommend using a fuel with between 10 and 15 percent nitromethane content; there's no mention of the oil percentage, however. As you may remember, my mix consists of 15 percent nitromethane and 20 percent lubricant (half Klotz*, half castor oil). The rest of the volume measure is C.P. methanol (chemically pure methyl alcohol). The low-load prop

Close-up view of one-piece front housing carburetor body. Lost wax process casting.



Front view of the dyno: Fitzpatrick, ready to run...yes, that's snow in the background!

chosen was a now-discontinued TF 11x6 Super M. We used the Fox* idle-bar long glow plug supplied with the engine.

The Fitzpatrick .61 was started and ran uneventfully for 2-minute periods, after which it was stopped and allowed to cool thoroughly. The needle-valve setting held the engine on the rich side of 2-cycling—not allowing it to 4-cycle.

At the 10-minute mark, the engine was peaked to maximum rpm so Frank could note the noise level on the dB meter.

My engineer friend announced, "109dB at 13,200rpm—the muffler works as expected."

For the next 20 minutes, we ran the engine for 2-minute intervals, and then 3 minutes—always observing its operation and adjusting the needle toward peak rpm for a few seconds, then backing it off (richening) to cool. By the end of the break-in session, we had learned several important things:

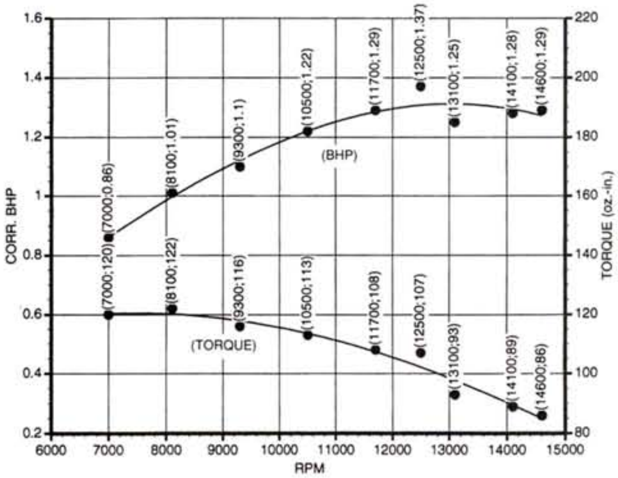
- The engine would hold a steady peak of 14,000rpm without overheating and sagging.
- The 109dB on the sound meter represented the second highest recorded noise level of any of our test sessions. (The Nelson* Quickie 500 racing engine was the highest.)
- After the Fox plug had burned an element, we replaced it with a K&B* 1L, and the engine performed better. We noticed that when the glow-plug

Trial	Propeller MFG. & SIZE	COMBINED RANK	GROUND		AIR RPM		AIR SPEED % OF MAXIMUM		dB @ 9'	R.A.D	°F WET BULB	°F DRYBULB	BAROMETER IN Hg
			RPM	THRUST(LB)	LOOP	STRAIGHT	LOOP	STRAIGHT					
1	APC 11-7	1	13,100	7.5	13,000	13,500	100% 54.1 mph	95%	109	98.5	58	65	30.02
2	APC 11-9	3	11,500	6.25	11,000	11,550	96%	93%		98.5	58	65	30.02
3	APC 11-10	6	10,500	5.13	10,920	11,000	93%	86%		99.3	52	69	30.16
4	APC 11-8	2	12,500	7.75	12,000	12,920	92%	100% 91.7 mph		99.3	52	69	30.16
5	REV-UP 11-71/2	4	12,800	7.00	12,500	13,500	87%	94%		98.5	58	65	30.02
6	REV-UP 11-8	5	12,000	6.63	12,320	12,830	86%	94%		99.3	52	69	30.16
7	APC 11-11	7	10,000	5.25	10,200	10,750	84%	91%		99.3	52	69	30.16
8	REV-UP 12-6	8	12,250	7.75	12,380	12,750	75%	82%		99.3	52	69	30.16
9	REV-UP 13-6	9	10,500	7.88	11,000	12,000	72%	79%		99.3	52	69	30.16
10	REV-UP 14-6	11	9,500	8.88	9,250	11,000	67%	76%		99.3	52	69	30.16
11	APC 12-10	10	9,250	5.75	8,750	9,500	63%	85%	98	99.3	52	69	30.16

Note: These represent two flight testing days. Fuel: 15% nitro—20% oil.

RPM	Torque (oz.-in.)	Corr. B.hp	B.hp	Corr. Factor	Distance (in.)	Coefficient	49.1
6,000						Wet Bulb (F)	51
7,000	120	0.86	0.83	1.03	2.444	Dry Bulb (F)	58
8,100	122	1.01	0.98	1.03	2.475	Bar Pres (Hg)	29.28
9,300	116	1.10	1.07	1.03	2.357	Vap Pres (Hg)	0.3
10,500	113	1.22	1.18	1.03	2.307		
11,700	108	1.29	1.25	1.03	2.207		
12,500	107	1.37	1.33	1.03	2.182		
13,100	93	1.25	1.21	1.03	1.9		
14,100	89	1.28	1.24	1.03	1.805		
14,600	86	1.29	1.25	1.03	1.743		
15,500							

Torque (oz.-in.) = Distance (in.) x Coefficient (see August '93 issue, page 61).



current was removed after starting, the rpm dropped by 200. This is usually a sign that the plug heat range is too cold. The K&B performed better and realized a 100rpm gain.

• These stock props were statically run to peak rpm for comparison purposes only. (Usually, RPM doesn't indulge in this basically meaningless exercise. But we wanted to establish a ballpark rpm range for the flying props that would have to be obtained.)

Top Flite* Power Point 11x8 .... 12,400rpm
Zinger* 11x7 ½ 12,600rpm
APC* 12x8 (C-2) 10,700rpm
APC 11x10 (C-2, 106dB) 11,000rpm
Graupner* 11x7 (Super, 108dB) .. 12,700rpm

DYNAMOMETER TEST: WIDE-OPEN THROTTLE

The dyno tests were conducted without incident, using nine load beams (non-pitched propellers; for a full description, see the August '93 issue of *Model Airplane News*). The engine experienced a high-speed "miss" with the lowest load (beam no. 10)—and acted like an over-compressed diesel. This happened at 14,600rpm. No amount of needle-valve adjusting would cure the problem. As a result, I didn't attempt to run the engine at a higher speed; the brake horsepower curve indicated that the engine had peaked at about 13,000rpm anyway. The torque was another matter—like something you would see with a 4-stroke-cycle engine. The peak occurs at about 7,500rpm. This is very unusual and indicates that the engine should swing a large load—happily. Before leaving the dyno chart/graph, look at the peak b.hp: about 1.3—not exceptional compared with other "sport" engines of similar displacement. Frank and I were anxious to investigate the Fitzpatrick "torquer" with the *real* test: flight performance.

FLIGHT-PERFORMANCE TEST

After a quick trip to a local hobby shop for props, Frank remarked, "Can't use these props for more than one engine test?"

"Come on, Frank; you know as well as I that all these engines have different shaft sizes. That means that the props are all drilled differently. Look at the Fitzpatrick; you had to machine brass bushings just so we could use the APC props. Besides, do we always want to run the same manufacturer's brand from test to test?"

Back at the shop, the .61 mounted nicely to the Airtrax 60. We use a radial mount that works well for any front rotary engine; in this case, the Fitzpatrick presented no problems matching up to the ship—even the throttle linkage behaved.

After several days of cold, wet, windy weather, we were finally able to get to the flying field. Besides the telemetering system, Frank has added static thrust measuring to our agenda for each propeller tested. He's working on a theory concerning the prediction of propeller performance, but I'll let him describe that in a future column.

We had unexpected problems for the first 3 hours and didn't obtain any meaningful data. The telemetering system worked well, except at the top of a loop in the rpm mode. It worked flawlessly for straight-line rpm and speed checks, including loop speed.

We tried all sorts of fixes, including moving the photocell sensor, changing the antenna three or four times and locking the microswitch mode controller because we thought that vibrations might be causing the problem. Each time a change was made, I had to fly the airplane to see if things worked. Finally, the system began to function so that reliable data could be retrieved.

We burned a gallon of fuel and tested eight propellers from the Rev-Up* and APC lines. The Fitzpatrick seemed to work better as the day wore on. The lowest sound-meter reading was 98dB at 9,500rpm (Rev-Up 14x6). The carburetor idled reliably at 2,750rpm. It's significant to note that the greatest static thrusts produced the poorest air speeds. (This we knew before starting, but it's always nice to have confirmation.)

At home, Frank and I independently analyzed the data from the day of testing. Several days later, I was pleasantly surprised to find that he had arrived at the same conclusion I had: we needed to fly some more propellers! So, it was back to the field to test three more units: Rev-Up 11x7½, APC 11x7 and APC 11x9. Besides the props, we wanted to test a fuel-delivery theory using a fuel pump. Our telemetering system now sported a new Deans* Mini Antenna. The two-piece unit was a breeze to install, and our dat-retrieval worked flawlessly during the

Comparing the button-head insert diameter with the cylinder inside diameter (see text).

Crankshaft assembly. Notice the "packed" volume of the web, ABC components with bar stock rod. Piston is high-silicon, aluminum-alloy while rod is fitted with a bronze bushing insert.

remaining tests without the aggravating occasional "blip" that Frank once had to contend with.

Our testing was hampered by turbulent gusts exceeding 35mph. Even the usually rock-steady Airtrax 60 test model had some difficulties. I was happy to conclude the session after the minimum required flights.

CONCLUSIONS

Since this was our first experience flight-testing only two manufacturers' propellers, we eagerly anticipated analyzing the collected data. Eleven flight props were tested—six APCs and five Rev-Ups. As usual, our testing procedure consisted of straight flight rpm and velocity determinations as well as top-of-the loop rpm and velocity numbers. By referring to the chart, you can see how these props fared against one another. The APC 11x7 won the loop competition, and finished a surprising second in the straight-line speed category. On the basis of its first and second placing, it was judged to be the best overall (combined) propeller for our combination of engine and airplane. Notice that the chart is set up in terms of percent of maximum air speed (the highest speed being 100 percent) to help clarify differences between straight and loop speed. Our combination operated at a high straight speed—between 90 and 100mph—and the best loop speed was 50 to 60mph.

The APC 11x8 won the straight-speed portion of our testing, closely followed by the APC 11x7. Both props operate near the b.hp peak (13,000rpm) for straight flight and loops. We were surprised that the large diameter and pitch props didn't perform better because the engine displays such a low torque peak (7,500rpm). The APC 12x10 and the Rev-Up 14x6, 13x6 and 12x6 were dismal failures compared with their higher-revving counterparts. These props would perform much better if the Fitzpatrick .61 was fitted to a high-drag, relatively low-speed model, such as a World War I biplane, or a thick-airfoiled, large-wing-area sport model that's designed to fly at 50 to 60mph. The Airtrax 60 doesn't fall into these categories.

Although the APC 11x7 was deemed best in the combined performance category, this setup was so loud that the police informed us that the neighbors had complained. Look at the noise level generated by this combination—a *wailing* 109dB. We quit testing at that point.

Our flight testing consumed almost 1½ gallons of fuel. This engine really consumes the fuel—almost 3 ounces a minute; that's more than any engine with a similar displacement thus far tested. This consumption was measured at the peak horsepower rpm (13,000) and can be expected to decrease when the engine is propped to lower rpm.

We did try an experiment using a Perry* oscillating fuel pump with the Fitzpatrick .61. The APC 11x9 propeller displayed the characteristic of running loop rpm lower than the ground (static) rpm. This has been an ongoing concern at RPM. It has been suggested by a number of individuals, including *Model Airplane News* contributing editor Andy Lennon, that it's simply a fuel delivery problem. Without dwelling on the details, we ran the 11x9 with and without the pump and found no significant difference. Now we're wondering if my pump (an item not used for the past 10 years) was working. So, the saga continues. Frank and I plan to test other pumps in the future to prove or disprove this theory.

Thanks to Howard Crispin, AMA's director of noise studies, for calibrating our Radio Shack sound meter. We now have two of these units—one of which will serve as a standard for comparison purposes. The Fitzpatrick .61 needs a realistic silencer to be operated at flying sites that demand noise control. Fortunately, after-market silencers, such as the Davis* Sound Master, can be used with a minimum of trouble. It's strange that the brothers didn't put as much thought into this important sub-assembly as they did with most of their engine. Time will tell whether they'll offer a silencer that works.

HITS AND MISSES

Hits

- Beautifully manufactured pieces of the best materials
- No signs of wear after almost three gallons of fuel
- Low rpm torque, which is inviting to scale modelers
- Very useful for applications requiring large, efficient props

Misses

- Ineffective "muffler" (Even with the slowly turning Rev-Up 14x6, it registered an unacceptable 98dB.)
- Highest fuel consumption of any .60-size engine tested
- Poor fit between the cylinder head button and the top of the cylinder (.003-inch clearance—much too loose for this application)

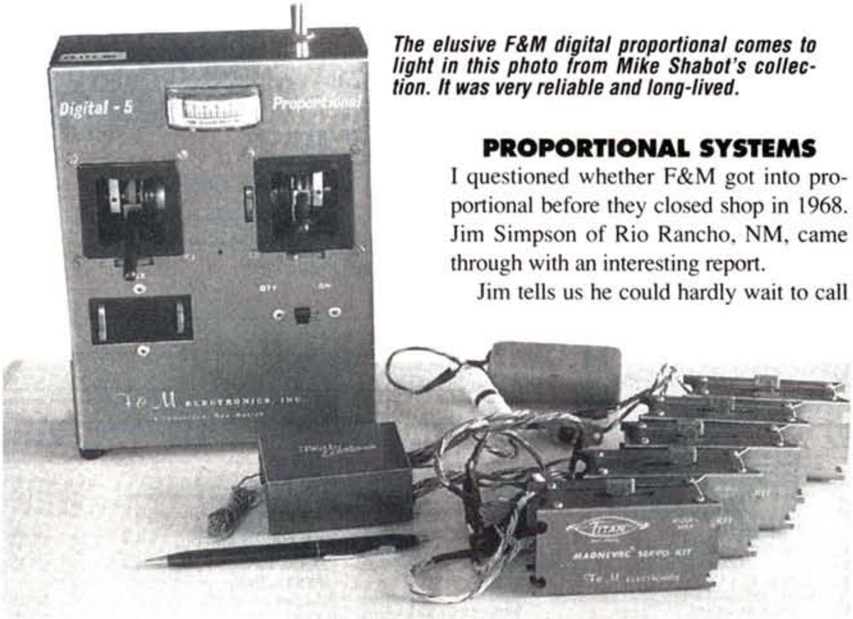
Comments: Do the claims they make for their engine ("highest-quality engine in the world;" "most powerful .61 in the sport market;" "best sport engine") hold true? There are others that, on any of these counts, are every bit as good and, in some respects, better. So the answer is no. I'm not sure what terms, such as "thermal dwell bar stock" and "unique, dynamically packed balanced crank-

(Continued on page 110)

GOLDEN AGE OF R/C

HAL DeBOLT

THE TIMELESS PROPORTIONAL SYSTEM



The elusive F&M digital proportional comes to light in this photo from Mike Shabot's collection. It was very reliable and long-lived.

IT LOOKS AS IF it's follow-up time. It has been great to hear how many of you have used Frank Hoover's C.G. Electronics Corp. and F&M equipment. The bottom line: this "good stuff" was the primary source of equipment in the Southwest during the early days of R/C.

INTO ORBIT

Al Knight of Woodbury, NJ, tells us that he was involved with Atlas missiles when John Glenn rode one into orbit. Al started his R/C activities at Walker Air Force Base, and like everyone else (he says) in New Mexico, he used F&M equipment. Al still has a single-channel Venus transmitter and a Pioneer super-regen receiver among his hoard of "goodies."

He also recalls that an R/C'er showed up at the field one day with a low-wing plane that was powered by a Thorp 45 with Orbit 8-channel reeds. Observers all thought that it was the *ultimate* model! Today, Al flies his *own* Astro Hog that's powered by a K&B .61 and controlled by Airtronics. Good things live on.

I appreciate the OT R/C data Al so thoughtfully supplied.

PROPORTIONAL SYSTEMS

I questioned whether F&M got into proportional before they closed shop in 1968. Jim Simpson of Rio Rancho, NM, came through with an interesting report.

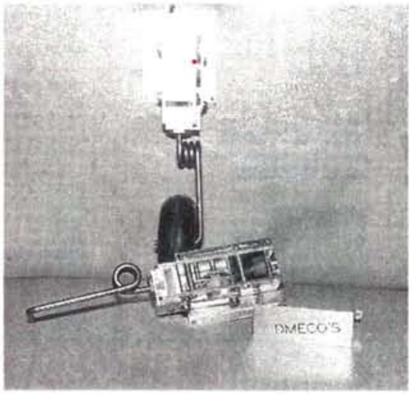
Jim tells us he could hardly wait to call his friend Frank Hoover and tell him about the F&M discussion. So now we know that 77-year-old Frank Hoover is doing well in a New Mexico retirement community. Frank enjoys golfing, but he wishes he could R/C his golf balls!

In 1963, Jim had been using Hoover equipment for many years when he heard that F&M would soon offer a proportional system. He called Albuquerque, and they assured him that he would receive one of the first available propos. Because he was stationed in northern California, he made a fast trip to the factory as soon as they told him the system was ready.

The system was digital (as it is now) and he even got checked out with it by Ted White. Does that name ring a bell? Ted is the R/C pilot extraordinaire whom even the experts marveled at. Ted could do things with an R/C airplane that seemed nigh impossible. One had to wonder how he got away with his derring-do demonstrations. His inverted passes were so low that he had skid marks on top of his rudder! If my memory serves, his favorite model design was the Derringer.

Jim remembers that he had a problem with his "new" propo dropping into "failsafe" occasionally (owners of innovative equipment could expect growing pains), but that was quickly corrected, and he enjoyed many years of fine flying with his F&M proportional.

Jim concludes by saying he flies at a mile-high altitude, and his 6-pound, 9-foot Dallaire Sportster OT'er climbs briskly at half throttle. The moral is: never shortchange wing area!



Jack Roth's major contribution to R/C was the first to make? retractable gears. They were unitized and electric-powered in an ingenious design.

MEMORIAL FOR TWO OT R/C'ERS

I'm sorry to report that we've lost two meritorious OT R/C'ers. They were steadfast members of the Flying Bison of Buffalo—one of the nation's most prestigious clubs during the '50s and '60s—and each man contributed to R/C in countless ways.

Genial and cordial, Jack Roth was a brilliant man who was bent on perfection and who had endless ambition. We saw him at the flying field daily during those early days, as he developed into an expert R/C'er.

Jack operated Roth Tool & Die, and he was noted for his ingenuity and precision tools. The shop produced the metal products that Dmeco offered, including the *first*

CANADIAN LIVE WIRES

The LW Rebel was a popular, single-channel kit that was made to fill a need expressed by Carolina R/C'ers—thus it was a rebel!

I've been waiting several years for an opportune time to show these lesser-known Live Wires from the '50s and '60s. I bet you'll appreciate these excellent photos that Ray Gareau of Laval, Quebec, went to great lengths to provide.

Powered by an O.S. .09, Ray's LW Rebel had Mickey Mouse escapements that were operated by a Min-X; a "kick-up" elevator; and engine control. Ray won many a contest with this combo.

The LW Rebel was a slicked-up, LW Trainer follow-on. It was greatly improved, because its design incorporated many of the lessons that were learned from earlier R/C models, and a substantial number were sold. Many of them were powered by .15 engines, instead of the .09 that it was intended for.

The LW Yankee was built and flown by a fellow club member of Ray. Powered by a Thorp .15, its rudder and engine were controlled by a rotary exhaust valve, which was popular at that time. This quick-to-build, single-channel craft followed the LW Rebel, and it was aimed at the great influx of C/L fliers who were into R/C enthusiasts. Sales were moderate, because interest in single-channel interest was waning.

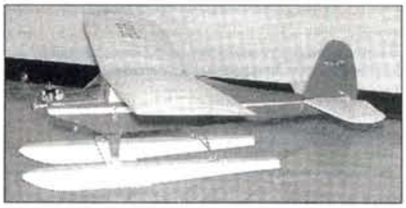
The single-channel LW Yankee was developed as a "quick build" to entice C/L fliers into R/C.

Many Canadians are fortunate to have a lake almost in their backyards, so "float-flying" has been popular in Canada from the start of R/C. This float-equipped LW Champion that belongs to Dick Baylis is an early example. Powered by an O.S. .19, it used a rotary exhaust valve for engine control.

The model was controlled by a single-channel radio, so the elevator was operated by a pulse-omission detector. Note the elevator counterbalance weights that were used to help the Mighty Midget engine actuator. Canada has long, snowy winters, so the Champ was also flown with skis attached to it (until the temperature dropped below 20 degrees; the radio couldn't work below that!).

COINCIDENCE?

A message from Ray came in today's mail. He tells us that he and his friends used F&M propo back in the '60s with excellent results. When he finally upgraded to another system, his son took the F&M over and enjoyed it for several more years. The F&M was used so much that the servo-wiper runners on the "PC" boards wore out and had to be replaced—amazing!



Is there any task R/C'ers haven't asked of the long-lived Champ? From training to crazy aerobatics to record-breaking, this model has seen it all—including water and snow!

Ray also writes that he was grounded (owing to vision problems) for a few years. He wondered whether he would ever fly again, but after a corneal transplant, he has again taken to the skies. Isn't today's medicine wonderful?

"steerable nose gears," which were both innovative and of jewel quality. He also produced Dmeco's visual-flow fuel tanks—the first "clunk"-style tanks. The "Knobis Kabobis" fuel filter was the first in-tank filter, and it replaced the clunk weight. His most outstanding achievement was probably the development and production of the *first commercial* retractable gears. They were self-contained, electric-powered units that featured fixed or steerable mounting.

Ronald Kirk was the other original Flying Bison who passed away recently. An immaculate modeler, he was involved in C/L activity, and he could always be counted on.

During WW II, the Cornell Aeronautical Laboratory was established in Buffalo. At the time, they boasted the world's largest wind tunnel, and smaller and hypersonic tunnels were added. Ron joined the lab as a tunnel operator, and he progressed up the ladder to supervise the tunnel division. Most of us would envy Ron's tunnel activity, which came during the frenzied WW II development period. Is there a modeler out there who wouldn't relish having been involved in perfecting many of the aircraft that eventually brought victory to the Allies?

During the development of the Interceptor pattern design, we were plagued by a "Dutch roll" tendency in windy weather. All sorts of solutions were tried, to no avail. Ron graciously evaluated the model in a tunnel, and he thought the problem was caused by a nasty vortex that was created by the wing-fuselage junction.

Here's an early Model Airplane News advertisement that features John Tatone's adjustable-pitch propeller. This very neat product would be valuable today.

Was he ever right! Adding a wing fillet neatly solved the problem.

A health problem forced Ron into retirement, and he had time once again to enjoy modeling. He was completely astounded by today's R/C capabilities, and he plunged into glider flying. Ron was a sustaining member and enthusiastic flier of the Clarence Soaring Society of Clarence, NY.

The best of us must leave when our time comes, but as with Jack Roth and Ron Kirk, there remains a vacant spot in the lives of those left behind.

ADJUSTABLE PROPS

Recently, we discussed Hi Johnson's variable-pitch propeller and how it attempted to solve our prop needs. Another attempt at a "better prop" from the same era has come to light. John Tatone Products offered an instant-pitch propeller that was "adjustable." The sales pitch (ha!) was that with such instant adjustability, you could try infinite pitch changes, tailoring for maximum performance. Offered in 10- and 11-inch diameters, the blade angle was adjustable from zero to 45 degrees. Why this idea wasn't widely accepted is a mystery. My guess is that the blade design just wasn't as efficient as the more common fixed props. As we see with full-scale planes, the adjustable feature has merit.

And so it goes. Note that this is *the* OT R/C place; you, too, can be part of it! ■

ADVERTISEMENT

AstroFlight News

Astro's New "Super" Chargers

Team Astro has redesigned the popular Model 112 charger to include peak detection and increased cell charging capabilities. The new 112PK "Super Charger" is a peak-detecting DC charger that can handle from 4 to 36 cells, 250 to 4000 mahr. It features a DC amp meter, a current adjust control for varying the charge rate from 1 to 5 amps, voltmeter jacks on the front panel to monitor your batteries' voltage, and an auxillary 100 mA trickle-charger to charge your reciever pack. The new 112PK also features a built-in cooling fan, and is input and output protected against both overload and polarity reversal

The 112 PK should be very popular with modelers charging anything from 3 and 4-cell free-flight packs all the way up to large 1/4 scale Cobalt 90 powered planes, high-powered boats such as the 32-cell Unlimited Hydros, and 14 to 20-cell drag racers using Team Astro Top Fuel 1 and II motors.

The new 112PK Peak Detector handles from 4 to 36 cells.

New Model 111XL AC/DC Charger

Team Astro's Model 111 charger has been improved! The new 111XL is a peak-detecting AC/DC charger that can charge from 1 to 8 cells on AC, and from 1 to 16 cells when using a 12V DC power source. It features a DC amp meter and a built-in DC/DC converter to eliminate false peaks caused by input voltage variation. The new 111XL also features a built-in cooling fan, and is fuse and diode protected against polarity reversal. The 111XL is short-circuit protected, and will not be damaged by shorting the output connections

The 111XL should be a hit with many modelers, including those charging 8-cell model helicopters, model airplanes up to 16-cells such as a Cobalt 25 powered Porterfield, R/C cars using the standard 4, 6, and 7-cell packs as well as 10 to 14 cell dragster packs, and R/C boat modelers in the 12-cell racing class. The 111XL is a versatile, dependable charger that works with household 110V AC or12V automobile batteries.

New Model 110XL DC Charger

Astro Flight's Model 110 charger has been upgraded with increased cell charging capability. The new 110XL is a peak-detecting DC charger that can handle from 1 to 16 cells, 250 to 4000 mahr. It features a DC amp meter, a current adjust control for varying the charge rate from 1 to 5 amps, and voltmeter jacks on the front panel to monitor your batteries' voltage. The new 110XL also features a built-in cooling fan, and is fuse and diode protected against reversal of the 12 volt DC input connection. The 110XL is short-circuit protected, and will not be damaged by shorting the ouput connections.

The 110XL should be very popular with modelers charging anything from 3 and 4-cell free-flight packs all the way up to large Cobalt 25 powered scale planes, high-powered boats in the 12-cell racing class, and 14-cell Open 1 Class truck pullers and Top Fuel drag racers using Team Astro Top Fuel 1 and II motors. □

For more information, see your hobby dealer or call AstroFlight directly at (310) 821-6242.

Astro Flight, Inc. • 13311 Beach Ave., Marina Del Rey, CA 90292

ENGINE REVIEW

(Continued from page 99)

shaft" really mean. The Fitzpatrick .61 should stand on its own merit; it's a good engine—not the greatest, but American-designed and North American-manufactured. Besides, today's hobbyists are better informed consumers. It's an honest attempt to compete for the sport and scale hobby market.

Here are the addresses of the companies mentioned in this article:

Fitzpatrick Engines, *9016 Wilshire Blvd., Beverly Hills, CA 90211.*

Airtrax; *distributed by L&R Aircraft, 13645 Fisher Rd., Burton, OH 44021.*

Webra; *distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821.*

Sheldon's Hobby Shop, *2135 Old Oakland Rd., San Jose, CA 95131.*

Klotz, *P.O. Box 11343, Fort Wayne, IN 46857.*

Fox Mfg. Co., *5305 Towson Ave., Ft. Smith, AR 72901.*

Nelson Competition Engines, *121 Pebble Creek Lane, Zelienople, PA 16063.*

K&B Mfg. Inc., *2100 College Dr., Lake Havasu City, AZ 86403.*

Top Flite Models; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*

Zinger; *distributed by J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.*

APC; *distributed by Landing Products, P.O. Box 938, Knights Landing, CA 95645.*

Graupner; *distributed by Hobby Lobby Int'l., 5614 Franklin Pike Cir., Brentwood, NJ 37027.*

Rev-Up; *distributed by Progress Mfg. Co., P.O. Box 1306, Manhattan, KS 66502.*

Deans Connectors; *distributed by Ace R/C, 116 W. 19th St., Box 511C, Higginsville, MO 64037.*

Perry Pump; *distributed by Varsane Products, 546 S. Pacific St., Ste. C-101, San Marcos, CA 92069.*

Davis Motor Sports, *750 Mobil Ave., Camarillo, CA 93010.* ■

PRODUCT NEWS

VENCON TECHNOLOGIES
Ultimate Battery Analyzer

This computer-controlled battery analyzer (UBA) is connected to your IBM PC or compatible serial port to determine the capacity of your rechargeable battery packs and print their discharge curves. It tests all flight packs and transmitter rechargeable batteries and all Ni-Cd battery packs from four to nine cells, with capacities from 10 to 10,000mAh. The UBA allows you to identify batteries that are about to fail. It also cycles your batteries, eliminates any "memory" effects and restores their capacity. Available in two models, both come with a one-year, full warranty.

Prices—$149.95 (dual channel); $99.95 (single channel) introductory offer.

Vencon Technologies, 5 Graymar Ave., Downsview, Ontario, M3H 3B5 Canada; (416) 398-4534.

KDI
Soxers

This ultralight landing gear with aerodynamic wheel pants is guaranteed not to break, and it also saves you time. Soxers include 2¼-inch Slim Line wheels, 5⁄32 wire gear and vinyl pants that come in red and MonoKote white and yellow. Safe for .40- to .60-size planes on paved runways and grass.

Price—$24.95

KDI, 10426 SE 206 Pl., Kent, WA 98031; (206) 854-8053 after 4 p.m. Pacific time.

RJL INDUSTRIES USA
K .61 Engine

The double ball bearing, Schnuerle-ported RJL K.61 with boost port uses the latest computer-controlled machinery to ensure exacting tolerances. The crankcase is an investment casting with a massive hardened-steel crankshaft that rotates on two ball bearings. The front ball bearing is sealed, and it's equipped with a re-circulating oiling system. The connecting rod is machined out of aluminum bar stock, and it has phosphorous bronze bushings at both ends. The piston is forged and domed for both power and crown strength. An O-ring seals the composite back cover.

Price—$189.95

RJL Industries, P.O. Box 5, Sierra Madre, CA 91025; (818) 359-0016.

DAYTON PLASTICS
Plastic Materials

Have you ever wondered where to get those hard-to-find plastics? Dayton Plastics, a plastics distributor in the Midwest, can ship materials worldwide to manufacturers and individuals—from high-tech materials for Stealth fighters to everyday materials. Full sheets or cut to size—no problem; you just pay for the material that you need. They carry ABS, acrylic, butyrate, Delrin, nylons, PETG, PVC, phenolic, G-10, polycarbonate (Lexan), polyethylenes, polyurethane, vinyl (flexible and rigid). Minimum order—$15. Please include $5 S&H.

Dayton Plastics, 2554 Needmore Rd., Dayton, OH 45414; (513) 276-3921; fax (513) 276-2403.

AEROCRAFT
Snapper 40

The Snapper 40 is a lightweight sport plane that's agile and responsive at high-power settings, yet it tracks like a pattern ship. It's equipped with dual rudders. The kit contains precision-machined, die-cut parts made of the finest balsa and plywood. The hardware package includes everything you need for pull-pull cable control of both the elevator and rudders, as well as the necessary horns, clevises, screws and threaded rod. There are also a formed plastic cowl and canopy, rolled plans and illustrated instructions. The Snapper 40 requires a standard 4-channel radio with five servos (dual aileron servos) and a .25 to .45 engine. Specifications: wingspan—52 inches; wing area—620 square inches; weight—4 to 4½ pounds.

Price—$84.95

Aerocraft Model Mfg., P.O. Box 553, East Northport, NY 11731; (516) 754-6628.

KASTNER ELECTRONIC DESIGNS
Aircraft Recovery Beacon

The Aircraft Recovery Beacon is a small electronic module designed to help you find downed R/C aircraft by emitting a loud, pulsating audio tone. It's powered by the aircraft's battery pack, and it consumes less than 0.1 milliamp of current when it's not in use. (The beacon is silent during flight.) Models can operate using battery packs that range from 3 to 12 volts. Specifications: weight—22 grams; measurements—1.8x1.2x0.8 inches.

Price: $19.95 (plus $2 S&H)

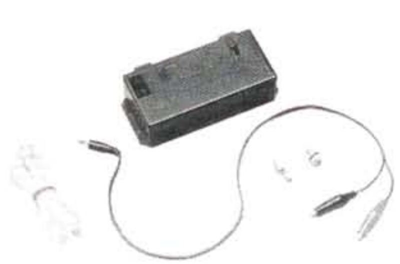
Kastner Electronic Designs, P.O. Box 20983, Dept. B4, Greenfield, WI 53220-0983; (414) 541-3768.

PRODUCT NEWS

HITEC
Multi Charge-A-Matic

The Multi-Charge-a-Matic has programmable 4- to 10-cell (4.8 to 12 volts), .9A to 4.5A charge rates and a programmable all-battery cycler feature. An auto-peak trickle circuit guarantees the safest charging possible, and this ensures a long life for any Ni-Cd. It includes an auto-cutoff alarm, polarity protection and a connector set for many different 12V sources.

Part no.—HCG325
Price—$99.95
Hitec RCD Inc., 10729 Wheatlands Ave., Ste. C, Santee, CA 92071; (619) 258-4940.



ROYAL PRODUCTS
Power Fuel Pump

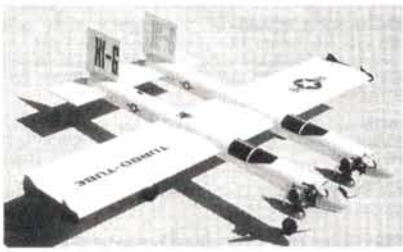
This fuel pump operates on four AA batteries and is capable of pumping 9 gallons of fuel without battery replacement. The pump can hang on the side of the fuel can or, using a special adapter, it can be strapped to a fuel bottle. The batteries are in the unit, and this makes the pump easier to transport. It comes with fuel tubing, a fuel-can filter and a filler nozzle. The wiring harness included with pump can be attached to a 6V battery or 6V power-panel source.

Price—$25.75
Royal Products Corp., 790 West Tennessee Ave., Denver, CO 80223-2835; (303) 778-7711.

TOP FLITE
Trim Seal Tool

The MonoKote Trim Seal Tool makes fast work of trimming a model's nooks and crannies by providing the right amount of heat, right where it's needed. It's perfect for applying graphics, pinstripes and other finishing details, whether they're simple or complex. Two special tips are included: one for fillets and curves, and one for flat surfaces and corners.

Part no.—TOPR2200
Price—$21.95
Top Flite; distributed by Great Planes Model Distributors, 1608 Interstate Dr., Champaign, IL 61821; (217) 398-3630.



HI-G
Turbo-Twin 45

The Turbo-Twin 45 by Hi-G is no ordinary ARF. No glue, paint or covering is required for assembly! The super-strong, plug-in, symmetrical-airfoil wings are completely assembled and painted. The generously sized ailerons have full-length, gapless hinges, and the control horns are installed. The tail section is painted balsa, spruce and ply with installed, gapless hinges, control surfaces and horns. The computer-designed, symmetrical airfoil provides excellent high-speed and low-speed flight performance. Specifications: wingspan—58 inches; wing area—520 square inches; radio—4 to 5 channel.

Price—$295
Hi-G, 2131 E. Crocus Dr., Phoenix, AZ 85022; (602) 788-5209.

LDM INDUSTRIES
The Strongbox™

The Strongbox™ is designed to provide both vibration isolation and crash protection for your receiver and battery pack. It features a tough outer case molded from polypropylene plastic that's lined with soft, vibration-absorbing foam. The tough outer case includes built-in mounting lugs. It will fit any 2- to 8-channel receiver and 50 to 800mA flat battery pack. Specifications: depth—2.4x2.7x4.1 inches; weight—1.9 ounces. LDM has also come out with The Strongbox™ II for giant-scale models (120 size or larger) that will accommodate a 2000mA battery pack.

Part nos.—8000 (Strongbox™); 8100 (Strongbox™ II).
Prices—$7.95; $11.95 (plus $3 S&H).
LDM Industries, Inc., P.O. Box 292396, Tampa, FL 33687-2396; phone/fax (813) 985-5616.

HOBBY LOBBY
Universal Mufflers

These Universal mufflers can be used on any engine, and all have aluminum baffles. The larger the muffler, the greater the silencing. The mufflers' outside diameter is 1 to $1\frac{1}{4}$ inches. The outside diameter of the inlet and outlet tubes is $\frac{7}{16}$ inch. The overall lengths are $4\frac{1}{2}$, $7\frac{1}{2}$ and $9\frac{1}{2}$ inches.

Hobby Lobby International Inc., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444.

Descriptions of products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, nor guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**.
Manufacturers! To have your products featured here, address the press releases to **Model Airplane News,** attention: Julie Soriano.

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R/C WORLD ORLANDO, FL, CONDO RENTAL: 2 bedroom, furnished. Available weekly or monthly. Low rates. 100-acre flying field with enclosed hangars. Close to Disney World and Epcot Center. For information, please call or write to R/C World, 1302 Stearman Ct., Orlando, FL 32825; (407) 380-6359.

VACUUM FORMING—Now in its third printing, the most comprehensive book on vacu-forming ever published for the hobbyist. 128 pages of hands-on information show how easy it really is to make your own plastic parts. Includes exclusive information on an easy-to-build, 2-stage vacuum system for truly professional results. It's easy! Try It! $9.95 + $1.05 postage. Vacuum Form, 272B Morganhill Dr., Lake Orion, MI 48360; (800) 737-3000. $1 surcharge for Visa/MC. [10/93]

WANTED: model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [6/94]

WANTED: your old proportional radios; interested in pre-1980, American made; C&S, Deans, Klinetronics Spar and others. Older is better. Ron Gwara, 21 Circle Dr., Waverly, NY 14892; (607) 565-7486. [9/94]

GIANT-SCALE PLANS by Hostetler. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667. [10/93]

WANTED: model-airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649. [6/93]

WANTED: built or partially built Ercoupes, Mooney M-10 Cadets, or Cessna 150, 152, 172, 182. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585. [10/93]

125 Plus kits for sale. Balsa plastic tools, list $1. Denhoff, 787 Pawnee, Carol Stream, IL 60188. [9/93]

SCALE AIRCRAFT DOCUMENTATION and RESOURCE GUIDE. World's largest commercial collection. Over 4,000 different color Foto-Paaks and more than 22,000 three-views. Catalogue—$5 ($10 foreign). Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. [2/94]

P/C—THE EASY WAY to simulate metal panels; $1 gets information and sample. Clarke Smiley, 23 Riverbend Rd., Newmarket, NH 03857. [12/93]

1930s to 1950s MODEL AIRPLANE MAGAZINES—1930s aviation pulps—complete and in good condition; $1 for list. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada, M5M 1W. [12/93]

ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send $2 for large list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537. [11/93]

LOCKHEED P-38 LIGHTNING—Are you a P-38 Lightning fan?—R/C models or full-size? Join the P-38 Model Organization International! For more information, send $1 to the P-38 Model Organization International, Medelbyvej 54, 2610 Rodovre, Copenhagen, Denmark. [2/94]

MAKE REAL DECALS with your computer and printer! Send $10 for starter kit and instructions to LABCO, 27563 Dover, Warren, MI 48093-4764. [10/93]

MISSILE SECRETS—engines, rockets, U-build. $2. Northtech-A5, 813 Cherry Ave., Albany, GA 31710

CARBON FIBER, 100 ft. 12K tow—$9.95 plus $2 S&H, for information send SASE to: DISCOUNT COMPOSITES, P.O. Box 96, Bountiful, UT 84011-0096. [11/93]

SCALE DOCUMENTATION: PLAN ENLARGING. 140 Super-scale, Sport and Giant R/C construction plans, three-views, cutaway drawings. More than 100,000 documentation photos in stock. 120-page catalog $5 ($10 air overseas). Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239. Visa/MC [4/94]

R/C WORLD-ORLANDO, FL—Condo for sale: 3 bedrooms, 2 baths, multi-acre flying field, enclosed hangar, swimming pool and tennis on site. Minutes from Disney and Epcot Center. Call Tom at Prudential Florida Realty; (407) 260-0057. [10/93]

WANTED: old engine parts, misc. junk before 1970. Wesley Pettinger, 1501 Banbury Ct., Richardson, TX 75082; (214) 669-4003. [7/94]

CUSTOM KIT BUILDING—Will build most kits from trainers to quarter scale. 20 years experience. Write for quotes, Midwest Model Factory, 280060 Highland Rd., Minatare, NE 69356. [9/93]

SALE—Kits wood, plastic, ignition engines, parts and mags (pre-1965) LSASE $.60. Specify needs. Leonard Roberts, 3819 Lydon Ln., Moosic, PA 18507; (717) 961-2357. [11/93]

PC-PERFORMANCE. Easy to use, menu-driven computer program predicts flight performance of R/C model aircraft. For IBM PC compatibles with monochrome or color graphics capability. Introductory price $15 + $3 S/H. Specify disk format. Softair, 10710 Evergreen Way #D305, Everett, WA 98204. [10/93]

R/C FLIERS DREAM COME TRUE. Vacation with your family, and bring your R/C plane! R/C World is a radio-control community with beautifully furnished condo (pool, tennis included), and one of the world's finest flying sites. All this only 20-30 minutes from Disney, Epcot, Universal Studios, Seaworld, and about 1 hour to Kennedy Space Center. For more information, call or write to Dave Patrick, P.O. Box 1385, Oak Park, IL 60304. (708) 771-6697. [1/94]

CLEVELAND KITS (AND PLANS) WANTED: Immediate cash, call or ship for offer. Ship to Jay Herbert, P.O. Box 1286, Mattituck, NY 11952. Phone (516) 298-4135 or fax (516) 298-4181. [3/94]

ANTIQUE IGNITION AND GLOW PARTS CATALOGE:100 pages–timers, needle valves, orginal cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 post-paid, U.S.; $20, foreign. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078. [2/94]

MAGAZINE BACK ISSUES—Flying Aces, MAN, Air Trails, 1930s and '40s. FM, RCM and more. Send SASE for list to Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [2/94]

WANTED—World War II and postwar recognition models. Old toy airplanes, cars, trucks, Zepplin, etc. Bill Fornwalt, 103 Dartmouth Ave., Johnstown, PA 15905. [11/93]

FOUR 1993 SCALE CATALOGUES—SPPS super-scale plans; SPPS scale documentation; ASP scale-plans handbook; ASP aircraft scale-drawings handbook (three-views); 140 different scale plans—120,000 photos. Catalogues—$5 each; overseas airmail, add $5 (1 to 4 catalogues); Visa, MC. Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239. [4/94]

IMPORTED DIESEL ENGINES—world's best selection: AE, AM, Aurora, Cipolla, KMD, MAP3, Mikro, MK-17, MVVS, Modela, PAW, Pfeffer, Letmo and USE diesels, plus very special imported glow engines, CO_2 motors and sailplane kits. Ten-page catalogue—$1. Carlson Engine Imports, 814 E. Marconi, Phoenix, AZ 85022-3112.

WANTED—unbuilt monogram Speed-E-Bilt kits from the 1950s—particularly a Stearman. John Gorday, 624 Concord Rd., Pelahatchie, MS 39145. [10/93]

SCALE WW I Plans: Send $1 for current list. "Smileys," 23 Riverbend Rd., Newmarket, NH 03857. [2/94]

BOOKS—"Tailless Tale"—tail-less aircraft for modelers: $38; "Structural Dimensioning of Radio-Guided Aeromodels"—building strong and light: $18; "On the Wing... The book"—tail-less R/C sailplanes: $28. Orders or information: B2 Streamlines, Dept. A, P.O. Box 976, Olalla, WA 983. [10/93]

CUSTOM KIT CUTTERS—your plans or anyone else's. Ask about our special price for the 53-inch Notforsale; 1/4-scale, 84-inch Notforsale; and our custom 1/4-scale G-Shark. Ask about our other kits and ARFs. For info, call (609) 448-1122. Orders only, call (800) 645-KITS. [10/93]

NEW ZEALAND AERO PRODUCTS—Scale plans: Agwagon, Pawnee, Pawnee Brave, Airtruk/Skyfarmer, Fletcher FU-24, Aerobat, Hall's Springfield Bulldog, Typhoon, DC-3/C-47, Fairchild PT-19/Fleet PT-26 and more. Fiberglass parts; hardware packs; timber packs; color photo packs available. Free documentation with plans. Catalogue/price list: $5 (U.S.); Visa/MC. 34 Ward Parade, Stirling Point, Bluff, New Zealand; (03)2128192.

FREE—Tesla turbine plans. Contact Dan, 1214 N. 6th St., Port Hueneme, CA 93041. [2/94]

WANTED— KRAFT KP-4/6 from 1964-66. Karlheinz Schmid, Stieranger 7, 8900 Augsburg 21, Germany. [2/94]

FIBERGLASS MASTER COMPANY is for sale; all or part. We have 700+ working molds for cowls, wheel pants and other parts to be made out of fiberglass. Asking price—$75,000. Call (703) 890-6017. [9/93]

MONTHLY R/C SWAPMEET delivered to your door! Nationwide buy/sell/trade newsletter with quick turn-around. Free sample copy and ad coupon. R/C Trader, P.O. Box 145, Big Lake, MN 55309; (612) 295-7521, 24 hrs. [9/93]

FOR SALE: F/A-18 Hornet .60 2C size, 68" length, 54" span. Built from G&P kit. Done in Blue Angels scheme, ready to fly except motor, tuned pipe, receiver and battery—$425. 81" PBY Catalina done in army colors ready to fly except engines, receiver, battery—$675. Call Bill (707) 965-1216. [10/93]

HARD-TO-FIND SPECIAL EFFECTS materials and parts. Send a self-addressed stamped envelope to: Uncle Waldo, Special Effect Supply, P.O. Box 2068, Salt Lake City, UT 84110-2068. [11/93]

PIRA FIBREGLASS PRODUCTS—quality cowls, wheel pants, cloth, tape, etc. Send $1 for list. 46 Portchester Ave., Singapore 1955; Tel/Fax 65-284-1888. [10/93]

INTERNATIONAL AIRCRAFT RESEARCH—need documentation? Include name of aircraft for availability of documentation with $3 for photo and 3-view catalogue. 1447 Helm Crt., Mississauga, Ontario, Canada L5J 3G3. [11/93]

THE PLANE FACTS NEWSLETTER! Dedicated to new and prospective pilots. Money-saving information, getting started, inside tips, how-to's. $15 for 12 monthly issues. Missouri residents, please add sales tax. The Plane Facts Newsletter, Dept. 101, 1533 NE Ivory Ln., Lee's Summit, MO 64063. [11/93]

FUTURISTIC DUCTED-FAN CONSTRUCTION VIDEO: A revolutionary way to build a ducted-fan, delta canard R/C aircraft with vectored thrust. The video takes you step by step from computer design construction to the actual flight. The aircraft is designed for easy building, high and low speed maneuverability and vertical flight capability. It's lightweight and AFFORDABLE. Look for it on sale late summer. For FREE details, proto type spec sheet and updates, write to: MVP, 2 Hinrichs Pl., Suite #2, Bloomfield, NJ 07002. [9/93]

WANTED: Controline Profile Kits; Midwest P-63, Skyraider, P-51, ME-109, Sterling Navion, Starfire, Skyshark, P-40, Sportster, Rotovalve, Dynamic 19/60, McCoy 19/35 RD/BL, K&B 19/35 grn. throttles; McCoy 19/35 R/C RD/BL engines, 3-line bellcranks. Paul Patterer, 114 Mosher Ave., Battle Creek, MI 49017; (616) 965-5364. [11/93]

HELICOPTER SCHOOL- 5 days of hands-on instruction with X-Cell helicopters and Futuba computer radios. Small classes tailored to your individual needs. Beginner to expert. Includes all meals and lodging. Over 300 satisfied students and 10,000 flights logged. Located on a 67-acre airport used exclusively for R/C training; owned and operated by Ernie Huber, five-time National Helicopter Champion and helicopter designer. Send for *free* information and class schedule *now!* R/C Flight Training Center, P.O. Box 727, Crescent City, FL 32112-0727, or call (800) 452-1677. Outside USA: (904) 698-4275, or fax (904) 698-4724. [12/94]

SHOP PLANS—Build a 24"x36" hobby cabinet that expands to 24"x72" work area. Send $2 for illustrations; $12 for full plans to Ernie Townsend, 74 Tidan Heights, 53279 Range Road 225, Sherwood Park, AB, T8A 4V1, CANADA. [11/93]

FOR SALE: R/C flight simulator. Dave Brown program and transmitter. New—$75. Victor Park, 1907 Mt. Vernon Ave., Point Pleasant, WV 25550. [11/93]

JET HANGAR HOBBIES JETS AVAILABLE. NIB or will custom build. Fair prices. Apprenticed by scale modeler Larry Wolfe. Call (407) 862-6644, or write: 625 S. Sweetwater Cove Blvd., Longwood, FL 32779. [10/93]

POLY BAGS! Mini-size ziplocks 1½"x 2", 2"x2", 2"x3". 50 assorted/$3.50. $4 hundred/per size. Order now! VAUGHNS, 407MA Byrnes, Allendale, SC 29810. [11/93]

PARACHUTIST! Release a scale-like parachutist! A real crowd pleaser and a lot of fun! For a brochure and jump contest rules, SASE: Hobby Hut Mfg., 2040 W. 21st St. N., Suite #77, Dept MAN, Wichita, KS 67203 [3/94]

GIANT-SCALE PLANS—Blohm and Voss BV-138 3-engine flying boat plus other maritime aircraft. Two stamps for listings. Gene Falada, Sea-Clusion Aeronautics, 22W070 Byron St., Addison, IL 60101. [11/93]

INSTRUCTORS SCARCE? Our VHS R/C flight instruction tapes will get you started! Free catalogue! Silicon Valley R/C Technologies: (800) 822-1500. [12/93]

WANNABE PRIVATE PILOTS! Find out what it *really* takes, not just how to become one. Comprehensive report reveals how to save time, frustration and money getting "your" wings. Free details! Stangel Aviation, 1034 Riverbend Dr. #12M, Hartford, WI 53027. [11/93]

DUCTED-FAN SYSTEM CHEAP! Suitable for gas or electric. Only a few available at $25. Send check to: Marcia Kelley, Rt. 5, Box 411, South Point, OH 45680. [10/93]

QUIET YOUR ENGINE with Koosh-In-It, a flexible, rubber-fabric laminate that "softens" engine vibration. Install it between the engine, engine mount and/or firewall. Pad measures 2½x4 inches and is 1/16 inch thick, and it can be cut easily with blade or scissors. Only $5.80, postage-paid. Balsadust, P.O. Box 078, New York, NY 10021-0078; (212) 737-0071. [3/94]

PLANS ENLARGED—Scanning/plotting services, model designer's computer software. Free information. Concept, P.O. 669E, Poway, CA 92074-0669; (619) 486-2464.

WRENCHES AND GASKETS for vintage and newer engines Bob McCord 325 Sylvan Mountain View, CA 94041. [3/94]

MOVING SALE: kits, engines, plans—$1 for list. John Murphy, Sr., 29 Cheryl Dr., Allanstown, NH 03275. [10/93]

CLUB OF THE MONTH

ABILENE R/C SOCIETY
P.O. BOX 1742, ABILENE, TX 79604

ONE OF THE most thankless jobs in the world is that of a newsletter editor. Most attain their lofty positions by default. Paul Sorrels, the editor of *Transmitter*—the newsletter of the Abilene R/C Society—says that he was "railroaded into the job" last year, but going by the look of his "On Approach" column, he has adapted well to his new role.

In the March '93 issue of *Transmitter*, he writes about the importance of field safety, suggesting that the flight stations at the club's field are too close to the runway. With more people at the field than ever before, he says the flight stations should be moved back to ensure everyone's safety.

We agree. A club's first priority should be safety. Making all the pilots feel safe and secure leads to better flying. The rest of the newsletter is just as interesting and includes columns called "Family Tips," "Model of the Month," "Balsa Scraps" and our favorite, "Dr. Prop"! We loved the one about solving engine problems by showing the sick engine a brand-new engine and telling it to "get its act together—or else!"

For a truly entertaining newsletter and for addressing important issues—with a sense of humor—we award our newest "Club of the Month" two free subscriptions. ■

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If so, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

PHOTO COURTESY OF BOB BANKA–SCALE MODEL RESEARCH

CONGRATULATIONS TO Alex Burr of Kennebunk, ME, for correctly identifying the June 1993 mystery plane. The Martin P4M-1 Mercator was designed as a long-range patrol aircraft for the U.S. Navy and was also known as the Martin Model 219. The aircraft was powered by two Pratt & Whitney R-4360-20A radial engines that were rated at 3,000hp each and two Allison J33 A-17 turbo jet engines that produced 4,000 pounds of thrust. The jet engines were positioned behind each radial engine and housed in the same engine nacelle. The plane had a 114-foot wingspan, an 85-foot length and a gross takeoff weight of more than 80,000 pounds. Its top speed was over 350mph, and it had an operating range of more than 3,000 miles.

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News.** If already a subscriber, the winner will receive a free one-year extension of his subscription.

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